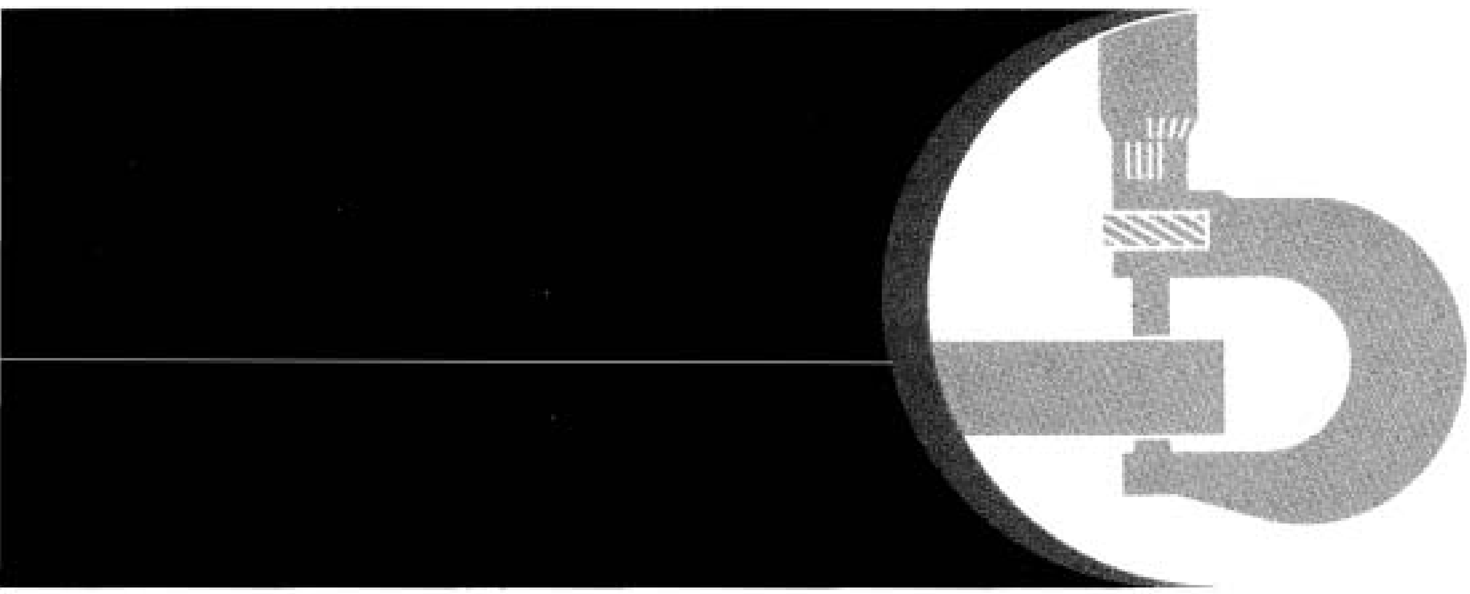
John Deere JD302 Tractor and Loader



TECHNICAL MANUAL

TM-1089

Litho in U.S.A.

JD302 TRACTOR AND LOADER

Technical Manual
TM-1089 (Dec-78)

CONTENTS

The specifications and design information contained in this manual were correct at the time it was printed. It is John Deere's policy to continually improve and update our machines. Therefore, the specifications and design information are subject to change without notice. Wherever applicable, specifications and design information are in accordance with SAE and ICED standards.

Litho in U.S.A.

INTRODUCTION

Use FOS Manuals for Reference

Use Technical Manuals for Actual Service

This technical manual is part of a twin concept of service:

The two kinds of manuals work as a team to give you both the general background and technical details of shop service.

- **FOS Manuals—for reference**

Fundamentals of Service (FOS) Manuals cover basic theory of operation, *fundamentals* of trouble shooting, *general* maintenance, and *basic* types of failures and their causes. FOS Manuals are for training new personnel and for reference by experienced technicians.

When service personnel should refer to a FOS Manual for more information, a FOS symbol like the one at the left is used in the TM to identify the reference.

- **Technical Manuals—for actual service**

Technical manuals are concise service guides for a *specific* machine. Technical manuals are on-the-job guides containing only the vital information needed by an experienced service technician.

This technical manual was planned and written for you—an experienced service technician. Keep it in a permanent binder in the shop where it is handy. Refer to it whenever in doubt about correct service procedures or specifications.

Some features of this manual:

- Inside front cover - "Table of Contents" and "Maintenance Without Accident"
- Section 10 - General specifications and services.
- Sections 20 through 60 - Removal, repair, testing (components removed), installation, and adjustment.
- Section 70 - Detailed explanation of system operation, diagnosis, visual inspection, testing, and adjustments.
- Specifications grouped and illustrated at the end of each section.
- Inside rear cover - Index.

Litho in U.S.A.

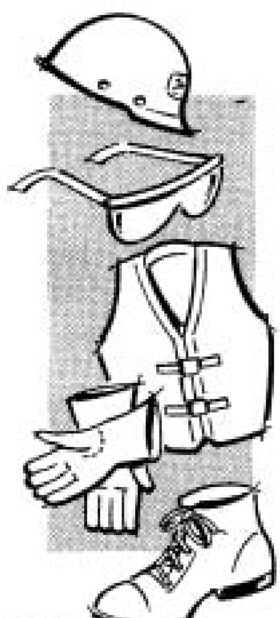
MAINTENANCE WITHOUT ACCIDENT

WORK SAFELY

T27999N

This safety alert symbol identifies important safety messages in this manual and on the tractor. When you see this symbol, be alert to the possibility of personal injury and carefully read the message that follows.

EVERY EMPLOYER HAS A SAFETY PROGRAM. KNOW WHAT IT IS!



T27601N

Consult your shop foreman for specific instructions on a job, and the safety equipment required.

For instance, you may need: Hard hat, safety shoes, safety goggles, heavy gloves, reflector vests, ear protectors, respirators.

T27602N

BE ALERT!

Plan ahead—work safely—know how to use a first-aid kit and a fire extinguisher—and where to get aid and assistance.

T27604N

Maintenance Area

Make sure the maintenance area is adequately vented.

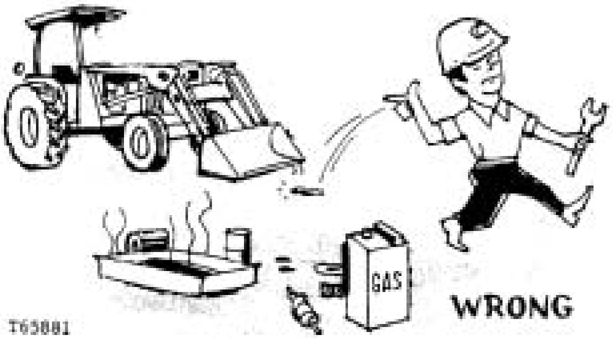
Keep maintenance area CLEAN AND DRY. Oily and wet floors are slippery; greasy rags are a fire hazard; wet spots are dangerous when working with electrical equipment.

Store starting aids in a cool and well-ventilated place, out of the reach of unauthorized personnel.

MAINTENANCE WITHOUT ACCIDENT

AVOID FIRE HAZARDS—

Fuel Is Dangerous!



T65881

Don't smoke while refueling.

Don't smoke while handling highly flammable material.

Engine should be shut off when refueling.

Use care in refueling if the engine is hot.

Don't use open pans of gasoline or diesel fuel for cleaning parts. Good commercial, nonflammable solvents are preferred.

Battery Gas Is Highly Flammable!

Provide adequate ventilation when charging batteries.

T27608N

Don't check battery charge by placing metal objects across the posts.

Don't allow sparks or open flame near batteries.

Don't smoke near battery.

Flame Is Not a Flashlight!

NEVER USE OPEN FLAME AROUND THE MACHINE.

KNOW WHERE FIRE EXTINGUISHERS ARE KEPT!

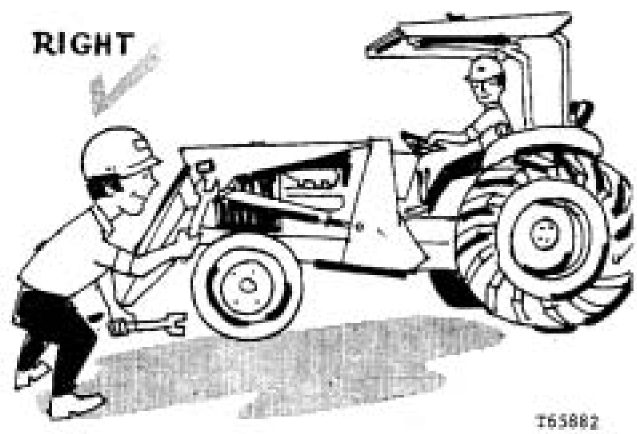
UNDER ALL MAINTENANCE CONDITIONS—

Do not perform any work on the equipment unless authorized to do so. Then be sure you know the safe and proper procedure.

Follow recommended procedures.

Never service the equipment while it is being operated.

Avoid working on equipment with the engine running.



T65882

If it is necessary to make checks with the engine running, **ALWAYS USE TWO** service technicians—one, the operator, at the controls, the other checking within sight of the operator.

KEEP HANDS AWAY FROM MOVING PARTS

Support all raised equipment.

Never work under raised bucket.

Lower bucket to ground.

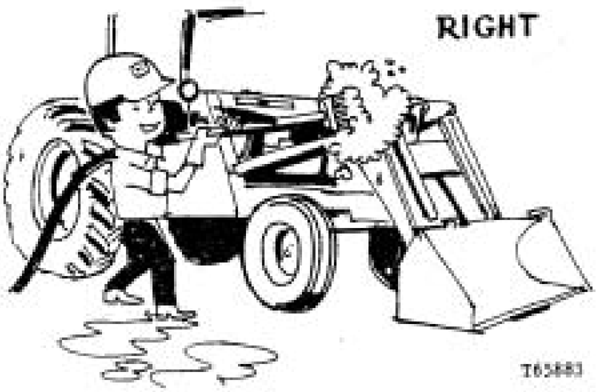
If the machine is on an incline, block it securely.

Use hoisting equipment for lifting heavy parts.

TAKE CARE! WATCH OUT FOR OTHER PEOPLE IN THE VICINITY

Wear safety glasses when drilling, grinding, or hammering metal.

SERVICING PRECAUTIONS



Keep ALL equipment free of dirt and oil.

Be sure to clean any oil, grease, mud, ice, or snow from floor of operator's compartment and stepping points.

When preparing the engine for storage, remember that inhibitor is volatile and therefore dangerous. Seal and tape openings after adding the inhibitor. Keep container tightly closed when not in use.

Don't remove the radiator cap until coolant temperature is below the boiling point. Then loosen cap slowly to the stop to relieve pressure before removing.

Periodically check exhaust system for excessive leakage.

Relieve hydraulic pressure before working on hydraulic system: shut off engine, lower bucket to ground, and move control levers and steering wheel until no response is felt.

When checking hydraulic pressure, be sure to use the correct test gauge.

PRECAUTIONS DURING REPAIR

Before working on hydraulic system relieve hydraulic pressure.

Before repairing the electrical system, or performing a major overhaul, disconnect batteries.

KNOW EQUIPMENT IS READY!

Check guards, canopies, safety guards — all protective devices installed on the unit. Every one should be in place and secure.

CHECK IT OUT!

- ☐ GUARDS
- ☐ CANOPIES
- ☐ SHIELDS
- ☐ PROTECTIVE DEVICES
- ☐ ROLL-OVER PROTECTIVE STRUCTURES
- ☐ SEAT BELTS, ETC.

Carefully inspect equipment for visual defects—leaks in fuel, lubrication, and hydraulic systems. Do not search for pressurized fluid leaks with your hands. Use cardboard or wood to search for leaks.

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Section 10
GENERAL

CONTENTS OF THIS SECTION

Group 5
GENERAL MACHINE SPECIFICATIONS

(Specifications and design subject to change without notice. Wherever applicable, specifications are in accordance with ICED and SAE Standards. Except where otherwise noted, these specifications are based on a unit equipped with 14.9-24, 6 ply rating rear tires; 11L-15, 8 ply rating front tires; 3/4 cu. yd. (0.57 m³) bucket; and standard equipment.)

Power (@ 2500 engine rpm):

	SAE	DIN
Gross	52 hp (38.8 kW*)	
Net	50 hp (37.3 kW)	53.2 PS

Net engine flywheel power is for an engine equipped with fan, air cleaner, water pump, lubricating oil pump, fuel pump, alternator, and muffler. Gross engine power is without fan. Flywheel power ratings are under SAE standard conditions of 500 ft. altitude and 85°F temperature and DIN 70 020 standard conditions of 760 mm Hg barometer (sea level) and 20°C temperature.
*In the International System of Units (SI), power is expressed in kilowatts (kW).

Engine: John Deere 3-cylinder diesel, valve-in-head, 4-stroke cycle

Bore and stroke .... 4.02x4.33 in. (102x110 mm)
Piston displacement .... 164 cu. in. (2687 cm³)
Compression ratio .... 16.2 to 1
Maximum torque
@ 1,300 rpm .... 129 lb-ft (175 Nm) (17.8 kg-m)
NACC or AMA (U.S. Tax) horsepower 19.4
Main bearings 4
Lubrication .... Pressure system with full flow filter
Cooling .... Pressurized with thermostat and fixed bypass
Fan .... Suction
Air cleaner .... Dry
Electrical system .... 12 volt with alternator
Battery (12 volt) reserve
capacity .... 60 minutes 110 minutes

Engine Clutch... Foot-operated: single 10 in. (254 mm) plate with reverser; single 11 in. (280 mm) plate without reverser

Transmission.... Constant mesh, 8 forward speeds, 4 reverse with helical gears and sliding collars; mechanical shuttle. Optional hydraulic direction reverser provides 8 speeds forward and 8 reverse: hydraulic wet clutches, no clutching required.

Gear:	Travel Speeds: mph Fwd.	mph Rev.	km/h Fwd.	km/h Rev.
1	1.3	1.6	2.1	2.6
2	1.9	2.2	3.1	3.5
3	2.9	3.3	4.7	5.3
4	4.0	4.7	6.4	7.6
5	5.3	6.2	8.5	10.0
6	7.6	8.8	12.2	14.2
7	11.2	13.0	18.0	20.9
8	15.7	18.3	25.3	29.4

Final Drives .... Inboard, planetary
Brakes... Hydraulically actuated, fully enclosed, wet-disk. Self-equalizing. Foot-operated individually or simultaneously.
Steering .... Manual
Turning radius (brake applied) .... 10 ft. 2 in. (3.10 m)
Loader clearance circle, dia.
(brake applied) .... 32 ft. (9.75 m)
Number of turns, far left to far right 3.3
Hydraulic System: Closed-center
Max. pressure 2350 psi (16 203 kPa) (165.2 kg/cm²)
Loader control.............................. 2-lever
Pump .... Piston, constant pressure, variable-displacement, 13 gpm (49 L/min) @ 2500 engine rpm

Hydraulic Cylinders:

	Bore	Stroke
Boom	2.25 in. (57 mm)	33.28 in. (845 mm)
Bucket	2.25 in. (57 mm)	24.56 in. (624 mm)

Cylinder rods. . Ground, heat-treated, chrome-plated polished
Boom,cylinder rods . . . . .1.5-in. (38 mm) dia.
Bucket cylinder rods . . . . .1.25-in. (32 mm) dia.

Tires:

	Front	Rear
Turf	27-9.50-15, 6 ply rating, I1 Terra tires	18.4-16A, 6 ply rating, R3
	27-9.50-15, 10 ply rating, I1 Terra tires	
Utility	6.50-16, 6 ply rating, I1	13.6-28, 4 ply rating, R1
	11L-15, 8 ply rating, I-1A	14.9-24, 6 ply rating, R4
	7.50/8.00-16, 6 ply rating F3	14.9-24, 6 ply rating, R3
		14.9-24, 6 ply rating, R1
		16.9-24, 6 ply rating, R3
		17.5L-24, 8 ply rating, R4

Front Axle . . . . .Swept-back, adjustable

Wheel Treads (dependent on tires and front axle):
Front . . . . 49 to 74 in. (1.25 to 1.88 m)
Rear . . . . 48 to 76 in. (1.22 to 1.93 m)

Capacities:

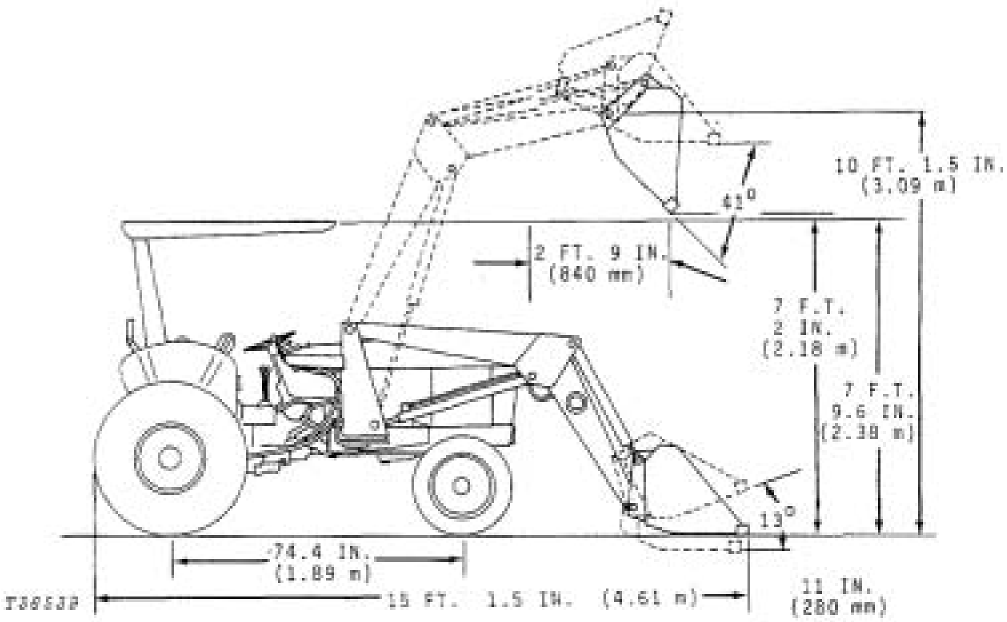
	U.S.	Liters
Cooling system	3 gal.	11.4
Fuel tank	19.5 gal.	73.8
Engine lubrication, including filter	6 qt.	5.7
Transmission and hydraulic system	10 gal.	37.9

Dimensions:
Height to top of hood. . . . . .4 ft. 7 in. (1.40 m)
Overall height to top of muffler. . .6 ft. 7 in. (2.01 m)
Overall height to top of canopy . .7 ft. 2 in. (2.18 m)
Overall width w/60 in. tread width . . . . .6 ft. 3 in. (1.90 m)
Overall length . . . . 15 ft. 1.5 in. (4.61 m)
Overall length w/3-point hitch . . 16 ft. 2.5 in. (4.94 m)
Wheelbase .74.4 in. (1.89 m)
Ground clearance (under front axle) .1 ft. 5 in. (430 mm)
Ground clearance, min. . . . . 11 in. (280 mm)

Additional Standard Equipment:
Oil pressure indicator light
Alternator charge indicator light
Coolant temperature gauge
Fuel gauge
Speed-hour meter
Horn
Key switch safety start
Cushioned seat
Vertical muffler w/rain cap
Transistorized voltage regulator
Fenders
Antifreeze
Two-position disk rear wheels
3/4 yard loader bucket
Air cleaner restriction indicator
Cigar lighter
Cold weather starting aid

SAE Operating Weight . . . . 6150 lb. (2 790 kg)

DIMENSIONS



Special Equipment:

Batteries (2); reserve capacity 220 minutes
Deluxe seat
Differential lock
Fixed front axle
Foot throttle
Front grille guard
Hydraulic direction reverser
Lights
Mid PTO (1000 rpm "live," w/rear PTO)
Muffler extension (vertical muffler)
Parking brake
Power steering
Rear muffler
Rear PTO (continuous "live" or independent 540 rpm)
Remove hydraulic cylinder
Single or dual remote-cylinder control w/quick-connect couplers
ROPS and seat belt, w/ or w/o canopy
Swinging drawbar
3-inch seat belt
3-point hitch (Category 1 or 2 w/sway blocks and regular or short links)
Toolbox

LOADER SPECIFICATIONS

Buckets:	Nominal Heaped Capacity	Width
	3/4 cu. yd. (0.57 m^3)	73.8 in. (1.88 m)

Operating Information:

Breakout force .... 4000 lb. (17.92 kN) (1814 kg)
Lifting capacity, full height .... 2500 lb. (1134 kg)
Raising time to full height .... 5.1 sec.
Bucket dump time .... 2.9 sec.
Lowering time (power) .... 3.0 sec.
Rollback time .... 2.6 sec.
Float-down time .... 6.1 sec.
Recommended rear ballast .... 2000 lb. (910 kg)

Group 10
PREDELIVERY, DELIVERY, AND AFTER-SALE SERVICES

TEMPORARY UNIT STORAGE

After receiving your unit from the factory and before putting the machine into temporary storage, perform the following checks and services.

For long term storage (over 30 days) information, consult your JD302 operator's manual.

1. Check battery electrolyte level and charge the battery, if necessary.

2. Check engine coolant level. Maintain midway between the radiator core and filler neck.

3. Fill the fuel tank.

4. Check crankcase oil level. Oil must be between marks on dipstick after machine has been shut down for 10 minutes.

5. Relieve hydraulic pressure by stopping engine, lowering bucket and operating control levers and steering wheel until system fails to respond.

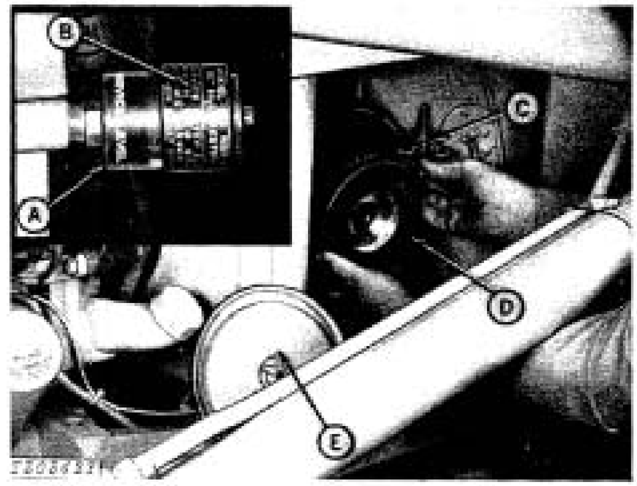
6. Reduce shipping pressure of all tires to the inflation pressure listed on page 10-10-2.

PREDELIVERY SERVICE

Because of the shipping factors involved, plus extra finishing touches that are necessary to promote customer satisfaction, proper predelivery service is of prime importance to the dealer and the customer.

Use the following list when preparing a unit for delivery to the customer.

1. Air Cleaner



A—Restriction Indicator
B—Red Signal
C—Wing Nut
D—Element
E—Cover

Fig. 1-Air Cleaner

Check air filter restriction indicator (A). If red signal can be fully seen, remove element (D) and clean. Install a new element if necessary.

Element checked *Yes* *No*

2. Radiator

Check engine coolant level.

CAUTION: Do not remove radiator filler cap unless the engine is cool. Then loosen the cap slowly to the stop to relieve pressure before removing the cap.

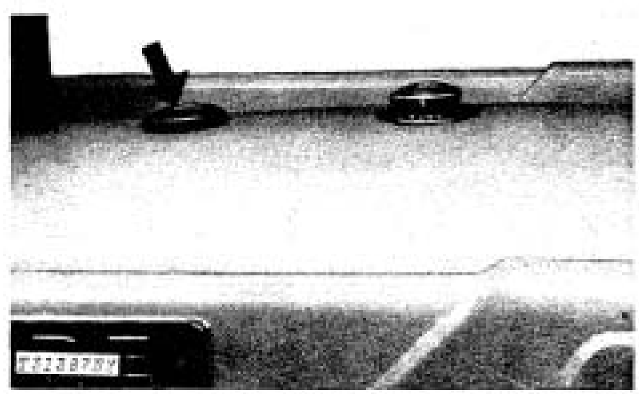


Fig. 2-Radiator Filler Cap

Maintain coolant level midway between the radiator core and the filler neck. If needed add clean soft water for warm weather, or a solution of 50% clean water and 50% ethylene glycol (permanent type antifreeze with approved rust inhibitor) for cold weather.

Check cooling system for loose connections and leaks.

Coolant level checked *Yes* *No*

4. Tire Pressure

Check tire pressure with an accurate gauge having 1 psi (0.07 bar) graduations.

Inflate tires according to the chart below.

3. Battery

Check battery electrolyte level. If distilled water is not available, use clean soft water. Avoid use of hard water. Remove foreign material from top of battery and coat terminals with petroleum jelly. Check vent holes in battery caps.

IMPORTANT: Never add water to battery in freezing weather unless engine will be run 2 or 3 hours.

Punch date code on battery.

Battery checked *Yes* *No*

FRONT TIRE INFLATION

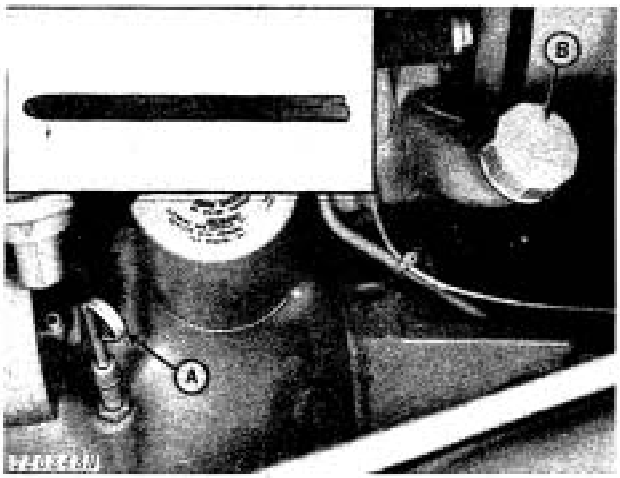
			Inflation Pressure		
Tire Size	Type	PR	With Towed or Rear-Mounted Equipment	With Light Front-Mounted Equipment	With Heavy Front-Mounted Equipment
6.50-16	I-1	6	36 psi (2.5 bar)	40 psi (2.8 bar)	48 psi (3.3 bar)
7.50/8.00-16	F-3	6	28 psi (1.9 bar)	32 psi (2.2 bar)	36 psi (2.5 bar)
27x9.50-15	I-1	6	35 psi (2.4 bar)	40 psi (2.8 bar)	Do not use
27x9.50-15	I-1	10	55 psi (3.8 bar)	60 psi (4.1 bar)	65 psi (4.5 bar)
11L-15	F-3	8	40 psi (2.8 bar)	40 psi (2.8 bar)	40 psi (2.8 bar)

REAR TIRE INFLATION

		Inflation Pressure		
Tire Size	PR	With Little Ballast or No Rear-Mounted Equipment	With Moderate Ballast or Light Rear-Mounted Equipment	With Maximum Ballast or Heavy Rear-Mounted Equipment
13.6-28	4	14 psi (1.0 bar)	14 psi (1.0 bar)	Do not use
14.9-24	6	14 psi (1.0 bar)	16 psi (1.1 bar)	18 psi (1.2 bar)
16.9-24	6	18 psi (1.2 bar)	20 psi (1.4 bar)	22 psi (1.5 bar)
17.5L-24	8	24 psi (1.7 bar)	24 psi (1.7 bar)	24 psi (1.7 bar)
18.4-16A	6	14 psi (1.0 bar)	14 psi (1.0 bar)	Do not use

Tire pressure checked *Yes* *No*

5. Crankcase Oil Level



A—Dipstick B—Oil Filler Cap

Fig. 3-Crankcase Oil Level

Check crankcase oil level with machine on level ground. Allow a minimum of 10 minutes for the oil to drain down before checking. If oil level is at or below bottom mark on dipstick, add oil specified on page 10-15-1 to bring oil level to between marks on dipstick. Do not operate engine with oil level below the bottom mark.

Crankcase oil level checked	*Yes*	*No*
Oil added		*qts. (L)*

6. Transmission Oil Level

Check transmission-hydraulic oil level.

Fig. 4-Transmission-Hydraulic System Dipstick Resting On Top Threads

Fig. 5-Transmission-Hydraulic System Filler Cap

Run engine two to three minutes to fill oil circuits. Check oil level with machine on level ground, engine running at slow idle, rockshaft and any equipment lowered, reverser lever (if equipped) locked in neutral, parking brake engaged (if equipped), range shift lever in park, and clutch engaged. Remove dipstick and wipe off oil. Insert dipstick with cap resting on threads of tube (not screwed in place). If oil level is down to bottom mark on dipstick, add oil. Remove filler cap on rockshaft housing and add oil specified on page 10-15-1 to bring oil level to top mark on dipstick.

Oil Level checked	*Yes*	*No*
Oil added		*qts. (L)*

7. Fuel Tank

Fill fuel tank with correct fuel. Check action of fuel gauge.

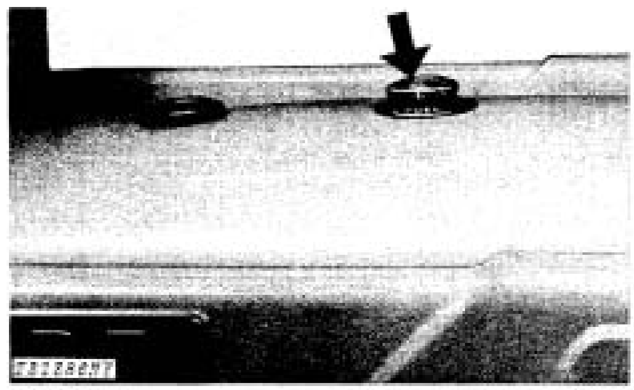
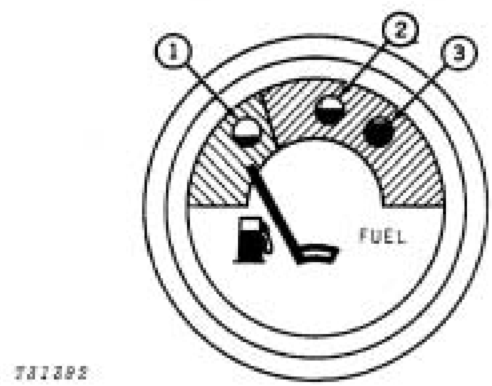


Fig. 6-Fuel Tank Filler Cap



1—Empty Tank 2—Half Full Tank 3—Full Tank

Fig. 7-Fuel Gauge

Fuel tank filled	*Yes*	*No*
Fuel gauge checked	*Yes*	*No*

8. Grease Fittings

All grease fittings were lubricated and checked before the unit left the factory. However, to insure customer satisfaction, check each fitting shown. Lubricate, if necessary, with John Deere Multi-Purpose Grease or an equivalent.

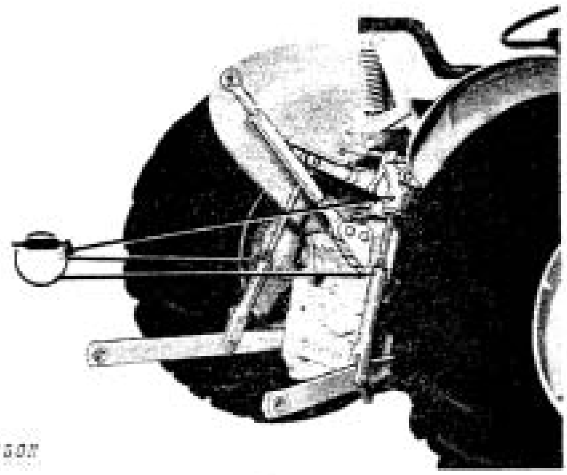


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Fig. 8-3-Point Hitch (3 points)

Lubrication required Yes No

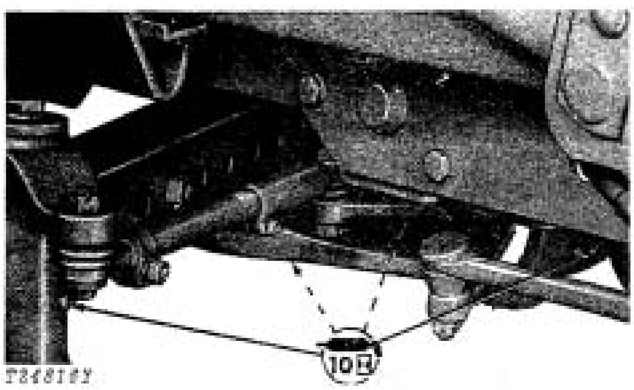

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Fig. 9-Front Axle Pivot Points (4 points)

Lubrication required Yes No

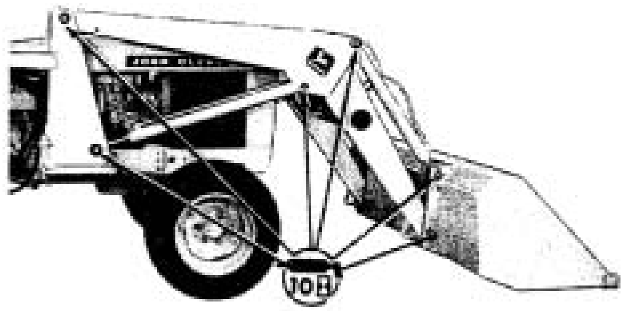

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Fig. 10-Loader Pivot Points (12 points)

Lubrication required Yes No

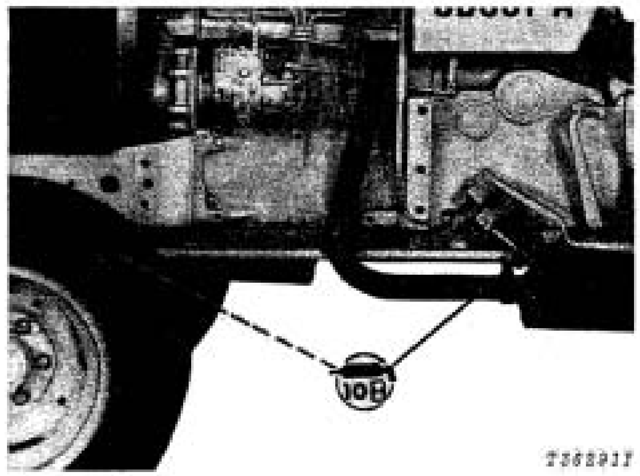

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Fig. 11-Drag Links (2 points)

Lubrication required Yes No

9. Air Intake Hoses

Check clamps on hoses connecting air cleaner and engine. Tighten hose clamps where necessary. Inspect hoses for cracks.

Intake hoses checked *Yes* *No*

10. Alternator - Fan Belt Tension

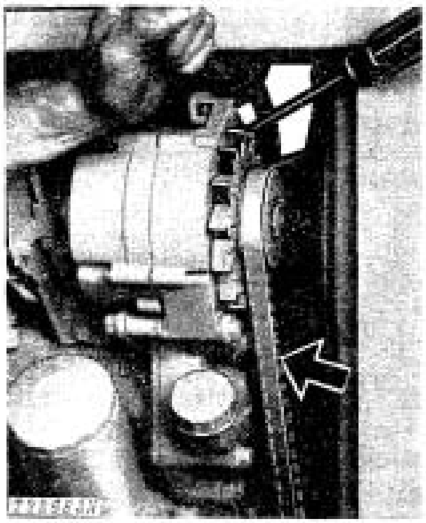


Fig. 12-Alternator - Fan Belt Tension

Check alternator-fan belt tension. Loosen the alternator bracket and adjusting cap screws. Apply outward force to the FRONT alternator frame until 20 lb (9 kg) force on the belt midway between the pulleys will deflect the belt 3/4 inch (19 mm). If a tension gauge is used, strand tension must be 90 lb (41 kg).

IMPORTANT: Do not pry on the rear of the alternator housing.

Belt tension checked *Yes* *No*

11. Engine Speeds

Check engine speeds.

Slow idle - 825 rpm
Fast idle - 2650 rpm hand throttle
2800 rpm foot throttle

If adjustment is needed, see page 10-10-18.

Engine speeds checked *Yes* *No*

12. Fuel Filter

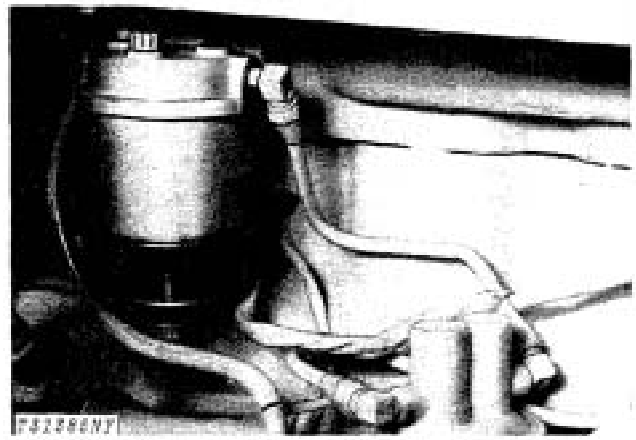


Fig. 13-Fuel Filter

Check fuel filter for sediment. Drain if necessary.

Fuel filter checked *Yes* *No*

13. Indicator Lights and Gauges

Check operation of indicator lights.

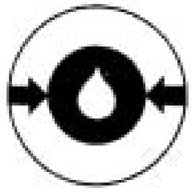


Fig. 14-Engine Oil Pressure Indicator Light

If light glows red when engine is running, stop engine immediately and determine cause.

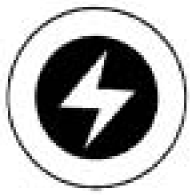
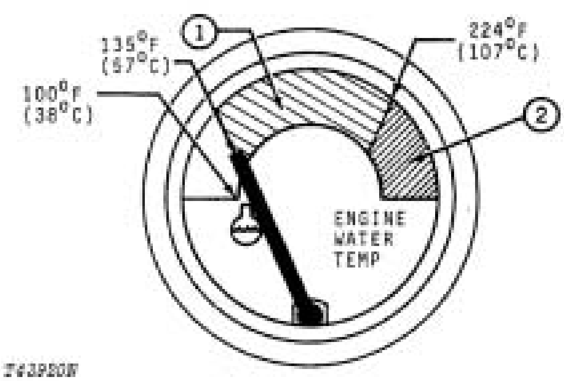


Fig. 15-Alternator Indicator Light

Light glows red when alternator is not charging. When light goes on with engine running, stop engine and determine cause.

Check operation of the engine coolant temperature gauge.



1—Operation Range **2—Overheat Range**

Fig. 16-Coolant Temperature Gauge

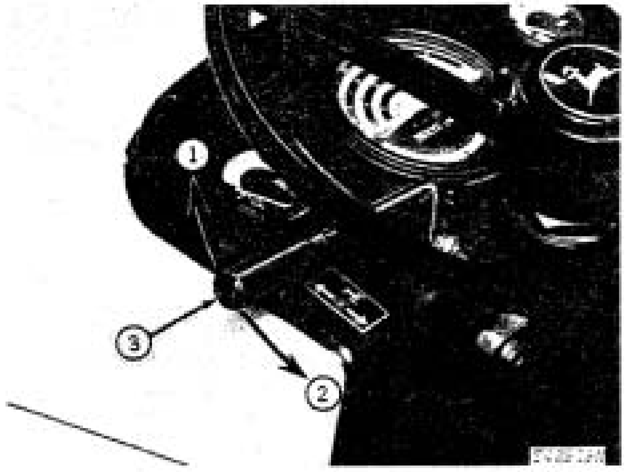
If the indicator hand goes into the red-orange zone, stop the engine. Check the cooling system.

NOTE: Fuel gauge is on page 10-10-3.

Indicator lights and gauges checked Yes No

14. Reverser

Check the reverser operation.



1—Forward **2—Reverse** **3—Neutral**

Fig. 17-Reverser Lever

The reverser unit allows the operator to change the direction of travel "on the go" without declutching or shifting gears.

Note and correct any reverser malfunctions.

See page 10-10-20 for reverser speed-of-shift adjustment.

Reverser checked Yes No

15. Differential Lock

Fig. 18-Differential Lock Pedal

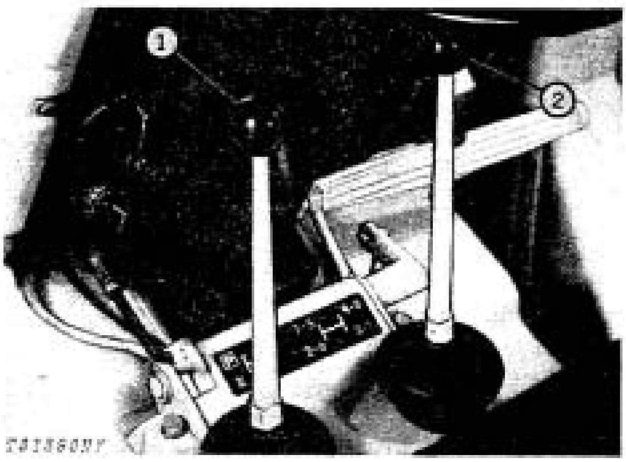
Check the differential lock operation.

While driving straight ahead, push down the differential lock pedal. Hold the pedal down. Turn the steering wheel slightly. There will be steering resistance if the differential lock is working correctly.

The differential lock will automatically disengage when the pedal is released if traction for both rear wheels is equal. Unequal traction will keep the lock engaged.

Differential lock checked *Yes* *No*

16. Transmission Shifting



1—Range Shift Lever **2—Gear Shift Lever**

Fig. 19-Transmission

Check the operation of the unit in all ranges and gears.

Correct any malfunctions.

Transmission shifting checked *Yes* *No*

17. Brakes

Check operation of brakes.

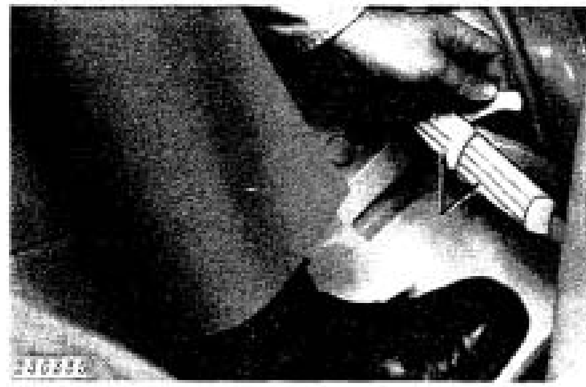


Fig. 20-Hydraulic Brakes

To stop the machine, push down both brake pedals. The machine must not pull to one side when stopping.

Turn to the left (L.H.). Push down the left (L.H.) brake pedal as you turn. Turn to the right (R.H.). Push down the right (R.H.) pedal as you turn.

The operator must feel the braking action pulling the machine to the left (L.H.) or right (R.H.). Brake action must be the same for both brakes.

Hydraulic brakes checked *Yes* *No*

18. Clutch Pedal Free Travel

Without Reverser (with continuous PTO)

Check the free travel of the clutch pedal. Free travel (1, Fig. 21) must be 1/2 in. (13 mm) to 1 in. (25 mm).

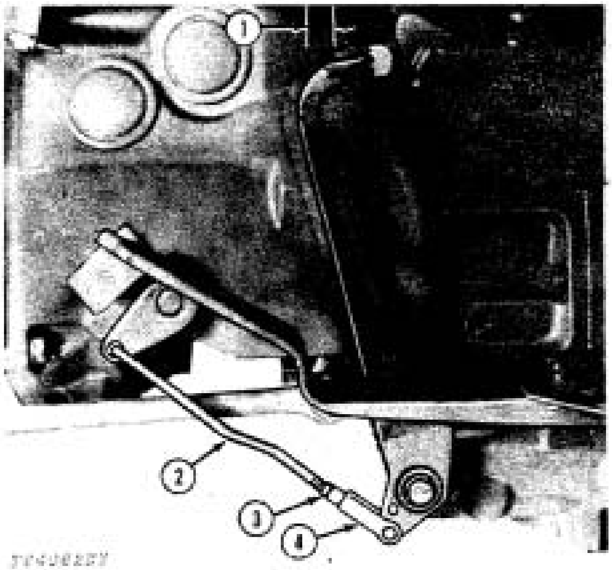
IMPORTANT: Do not operate the machine when the free travel of the clutch pedal is less than 1/2 inch (13 mm).

See page 10-10-22 for adjustment of free travel.

Without Reverser (with no PTO or with independent PTO)

Push the clutch pedal down until the clutch fingers contact the throwout bearing. Measure the distance from the pedal arm to where the pedal arm contacts the pedal stop. This distance must be 5 in. (127 mm).

If adjustment is needed, see page 10-10-22.



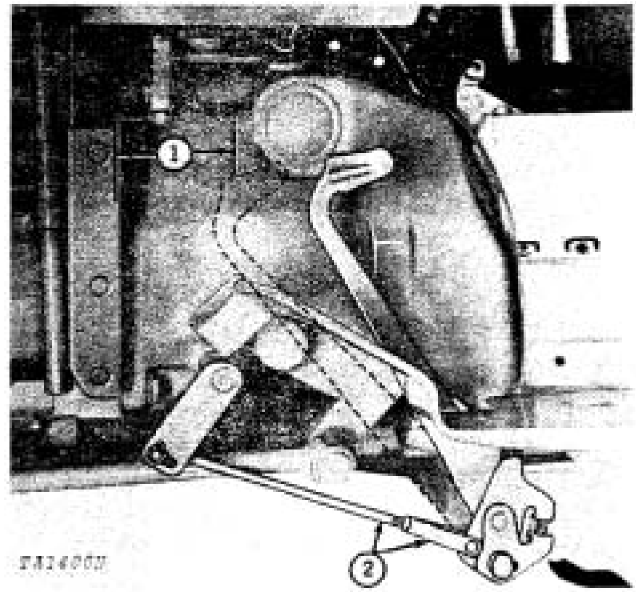
1—Specified Free Travel
2—Clutch Rod
3—Jam Nut
4—Yoke

Fig. 21-Clutch Pedal Free Travel (Without Reverser)

With Reverser

Check the free travel of the clutch pedal. Push the pedal down to the bottom of the first stage detent. In this position the throwout bearing will be against the clutch fingers. The top right (R.H.) edge of the rear of the pad of the clutch pedal must be 5-1/4 in. (133 mm) to 5-3/4 in. (146 mm) from the front of the bolting flange of the clutch housing. See 1, Fig. 22.

If free travel is more than 5-3/4 in. (146 mm), see page 10-10-22 for adjustment.



1—5-1/4 inches (133 mm) to 5-3/4 (146 mm)
2—Pedal Adjusting Rod and Yoke

Fig. 22-Clutch Pedal Free Travel (With Reverser)

Free travel checked Yes No

19. Engine Crankcase Vent Tube

Remove the vent tube. Clean it with diesel fuel. Install the vent tube. Be sure the packing fits correctly in the tappet cover.

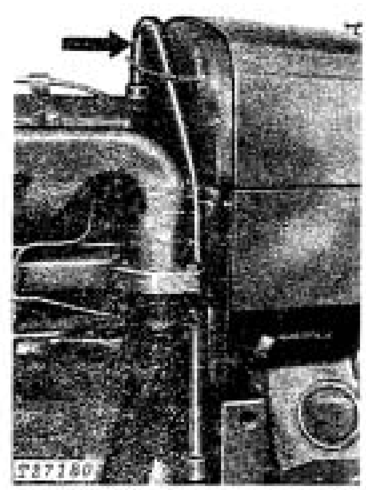


Fig. 23-Crankcase Vent Tube

Vent tube cleaned Yes No

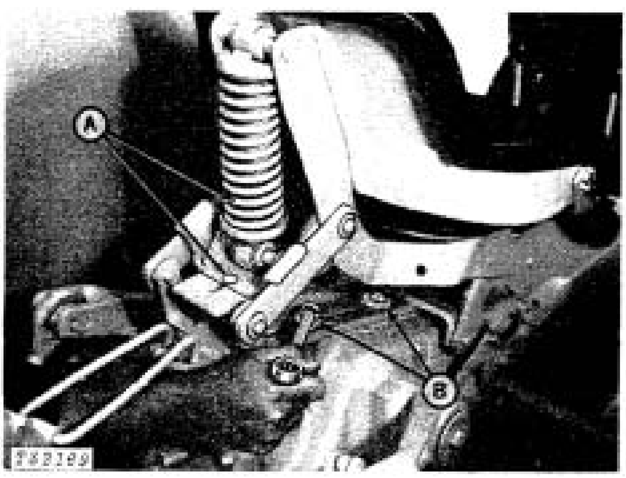
20. Seat

Check the operation of the seat.

Fig. 24-Seat Release Latch (Deluxe Seat)

To move the seat to the upper rear position for standing, lift the release latch (Fig. 24). Stand. Lift the seat to the upper rear position.

To move the seat back to normal position, pull the seat forward. The seat will automatically go back to normal position when you sit.



A—Weight Adjustment **B—Height Adjustment**

Fig. 25-Seat Adjustments

To change the adjustment for the height of the seat, loosen the cap screws (B, Fig. 25). Slide the seat to the desired position. Tighten the cap screws thoroughly.

To change the adjustment for the weight of the operator, move the seat to the upper rear position. Loosen the wing nuts under the support for the shock absorber. Slide the support to the desired position. Tighten the wing nuts.

Seat operation checked *Yes* *No*

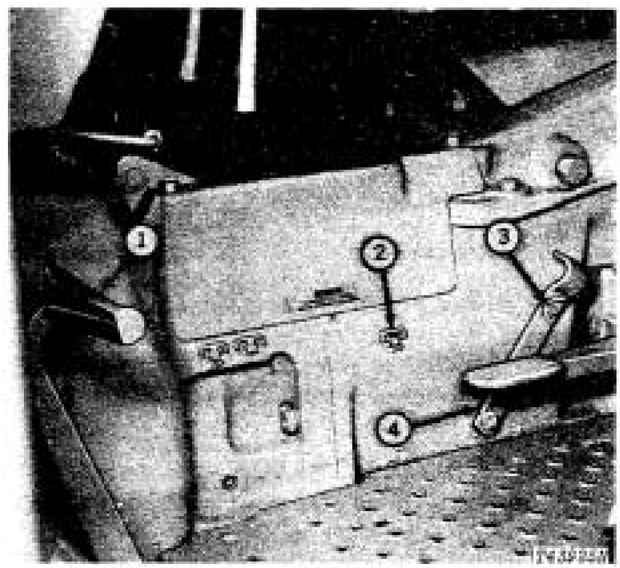
21. Power Steering

Check the operation of the power steering. The steering wheel must turn freely in both directions without seizure or too much play.

Power steering checked *Yes* *No*

22. Power Take-Off

Check power take-off operation.



1—PTO Clutch **3—Off**
2—On **4—PTO Lever**

Fig. 26-PTO Operation

IMPORTANT: Disengage PTO clutch at pedal before shifting PTO selector lever. PTO lever must be in fully engaged or "ON" position to avoid excessive spline wear.

Continuous-Running PTO

To engage the PTO, completely depress the clutch pedal (momentarily wait for machine motion to stop). Move the PTO selector lever to the "ON" position. Slowly engage the clutch pedal.

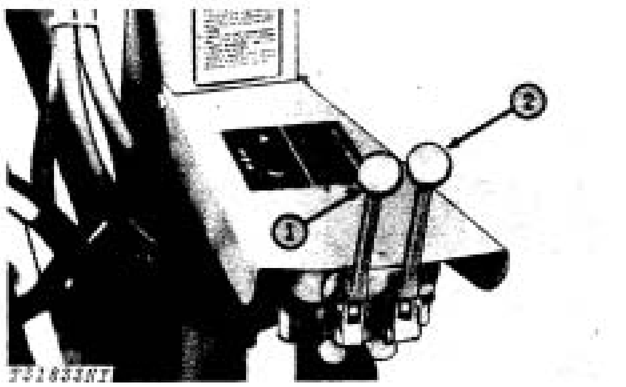
To disengage the PTO, completely depress the clutch pedal. Shift the selector lever to the "OFF" position.

IMPORTANT: Always disconnect rear PTO stub shafts when not in use.

PTO operation checked Yes No

23. Loader Control Levers

Check the operation of the loader control levers.



1—Bucket Control Lever **2—Boom Control Lever**

Fig. 27-Loader Control Levers

CAUTION: Reduce boom lift speed when raising loaded bucket to full height.

Boom Lever

Push the lever forward to lower the boom. Pull the lever rearward to raise the boom.

If the lever is released during normal loader operation, it will return to neutral. The boom will be held in the position reached at that time.

Push the boom control lever all the way forward for float position. The lever will stay in this position until it is manually returned to neutral.

Bucket Lever

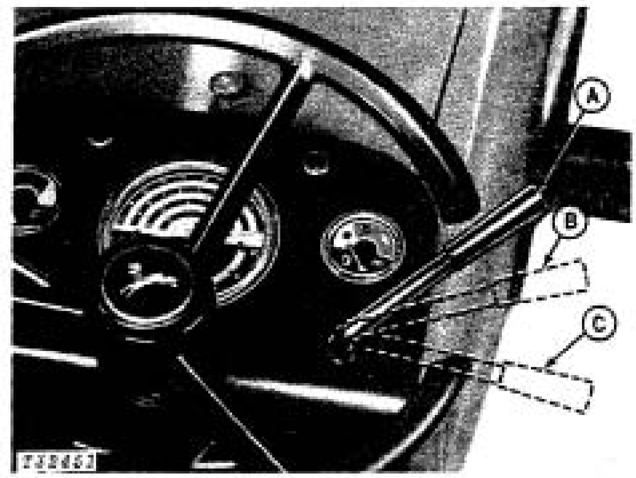
Push the lever forward to dump the bucket. Pull the lever rearward to retract the bucket.

If the lever is released, it will return to neutral. The bucket will be held in the position reached at that time.

Loader control levers checked Yes No

24. Hand Throttle

Check operation of hand throttle.



A—Slow Idle **B—PTO Speed** **C—Fast Idle**

Fig. 28-Hand Throttle

Hand throttle checked Yes No

25. Lights

Check the operation of the lights.

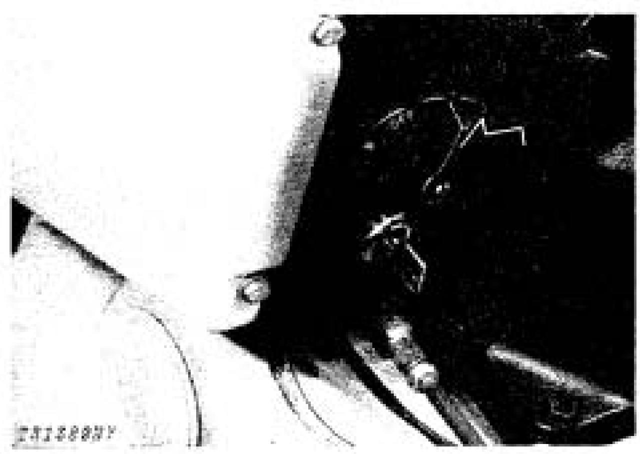


Fig. 29-Light Switch

Position	Headlights	Warning Lamps	Rear Combination Light
OFF	Off	Off	Off
W		On	
F	Dim		White
H	Bright	On	Red
H2	Dim	On	Red

NOTE: If customer desires, wire the lights to turn on when the key switch is off. Remove the purple wire from the "BAT" terminal. Install the unused red wire coming from the circuit breaker. Tape the end of the purple wire.

All lights checked Yes No

26. Parking Brake

Check the operation of the parking brake.

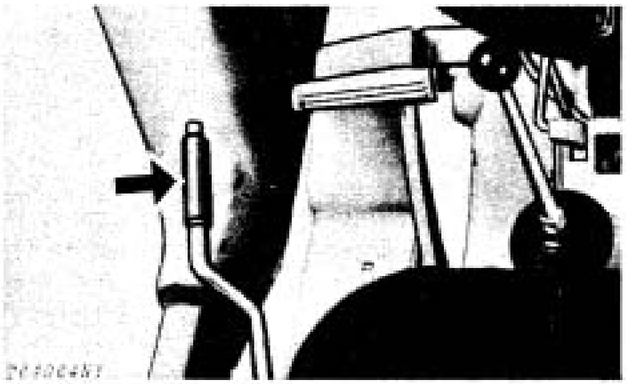


Fig. 30-Parking Brake

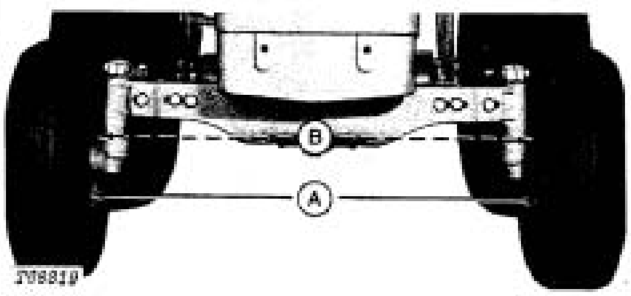
1. To engage, pull up.
2. To disengage, press button and push lever down.

If adjustment is needed, see page 10-10-25.

Parking brake checked Yes No

27. Toe-In

Check the front wheel toe-in.



A—Distance Between Front of Rims **B—Distance Between Rear of Rims**

Fig. 31-Checking Toe-In

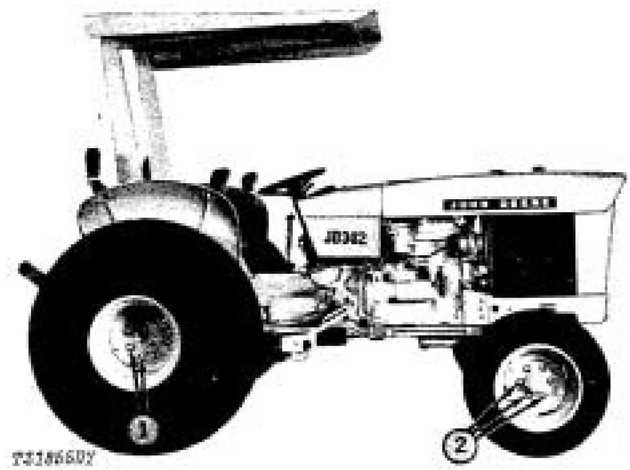
1. Use down pressure of loader bucket to raise front wheels. Turn wheels so each valve stem is at bottom of tire.
2. Lower wheels to ground.
3. Measure from ground to hub.
4. Mark this distance on inside of each rim at the bead of tire front (A) and rear (B).
5. Measure distance between rims at front and rear marks.
6. Distance between front of rims must be 1/8 to 3/8 in. (3 to 9.5 mm) less than distance between rear of rims.

If adjustment is needed, see page 10-10-27.

Toe-in checked Yes No

28. Wheel Retainers

Check the torque of the wheel retainers.



1—Rear Wheel Retainer **2—Front Wheel Retainer**

Fig. 32-Wheel Retainers

Tighten front and rear wheel retainers to 100 lb-ft (14 kg-m).

Wheel retainers checked Yes No

29. Accessible Hardware Torque Values

Check all accessible bolts and nuts for correct tightness. If any bolts or nuts are loose, tighten them to the correct torque. See the torque chart on page 10-10-28.

Accessible hardware checked Yes No

30. Final Check

The final predelivery procedure is the overall clean-up of the unit. Make the unit LOOK like a new machine with the proper touch-up of chipped paint and a good wash job. Deliver to the customer a tractor anyone would be proud to own.

DELIVERY SERVICE

A thorough discussion of the operation and service of this tractor at the time of delivery helps to assure complete customer satisfaction. Proper delivery should be an important phase of a dealer's program. A portion of the John Deere Delivery Receipt emphasizes the importance of proper delivery service.

Many complaints arise because the owner was not shown how to operate and service the new tractor properly. Devote enough time, at the customer's convenience, to introduce the owner to the new tractor and explain how to operate and service it.

The following procedure is recommended before the service technician and owner complete the delivery acknowledgments portion of the Delivery Receipt.

Use the operator's manual as a guide to be sure that the owner understands these points thoroughly.

1. The importance of safety.
2. The importance of lubrication and periodic services.
3. The importance of the break-in period.
4. Controls and instruments.
5. How to start and stop the engine.
6. All functions of the hydraulic system.

After explaining and demonstrating the above features, have the owner sign the Delivery Receipt and give the owner the operator's manual.

AFTER-SALE INSPECTION

The purchaser of a new John Deere tractor is entitled to a free inspection at some mutually agreeable time within the warranty period after the equipment has been "run-in," usually after 50 to 100 hours of tractor operation. The terms of this after-sale inspection are outlined on the customer's John Deere Delivery Receipt.

The purpose of this inspection is to make sure that the customer is receiving satisfactory performance from the tractor. At the same time, the inspection should reveal whether or not the tractor is being operated, lubricated, and serviced properly.

If the recommended after-sale service inspection is followed, the dealer can eliminate a needless volume of service work by preventing minor irregularities from developing into serious problems later on. This will promote strong dealer-customer relations and present the dealer an opportunity to answer questions that may have arisen during the first few days of operation.

During the inspection service, the dealer has the further opportunity of promoting the possible sale of other new equipment.

Check operation of all controls and instruments for freedom of movement and correct operation.

1. Engine Crankcase Oil and Filter

NOTE: Check with the customer if oil has been changed and filter replaced before performing this service.

Normal sequence of service is as follows:

Oil and filter change - after first 100 hours
Oil change - every 200 hours thereafter
Filter change - every 200 hours thereafter

If changed, record information below:

Approximate hours at change ______

If not, change as follows:

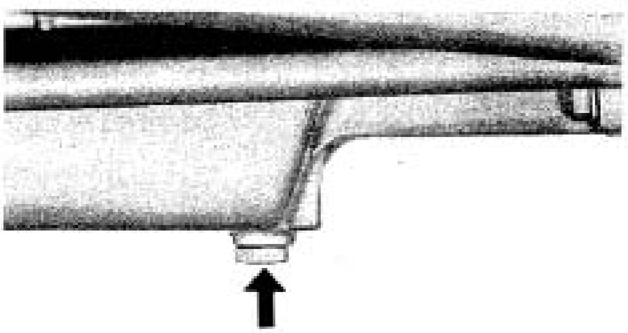


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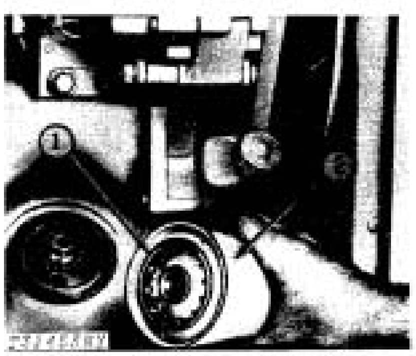
Fig. 33-Crankcase Drain Plug

When the engine is warm, remove the crankcase drain plug and drain the oil from crankcase.

While the crankcase is draining, remove the crankcase filter.

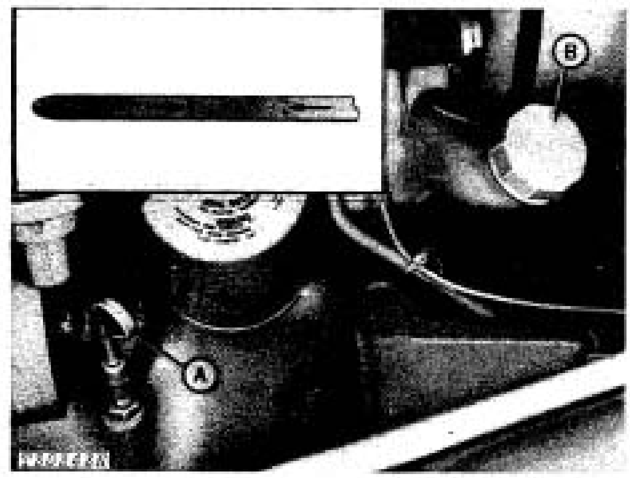


1—Sealing Ring **2—Filter**

Fig. 34-Crankcase Oil Filter

Turn the filter counterclockwise and discard it. Thoroughly clean filter mounting surface and install new filter. Apply a thin film of oil to the sealing ring. Turn the filter clockwise by hand until sealing ring just touches mounting pad. Then turn down an additional 1/2 to 3/4 turn. Do not overtighten.

Install drain plug.



A—Dipstick **B—Oil Filler Cap**

Fig. 35-Crankcase Oil Level

Remove filler cap (B). Add 6 quarts (5.7 L) of oil specified on page 10-15-1.

Start the engine. Check for leaks around drain plug and filter. Retighten only enough to stop leaks. Do not overtighten.

Stop the engine. Check the oil level.

Engine oil changed	*Yes*	*No*
Oil filter changed	*Yes*	*No*

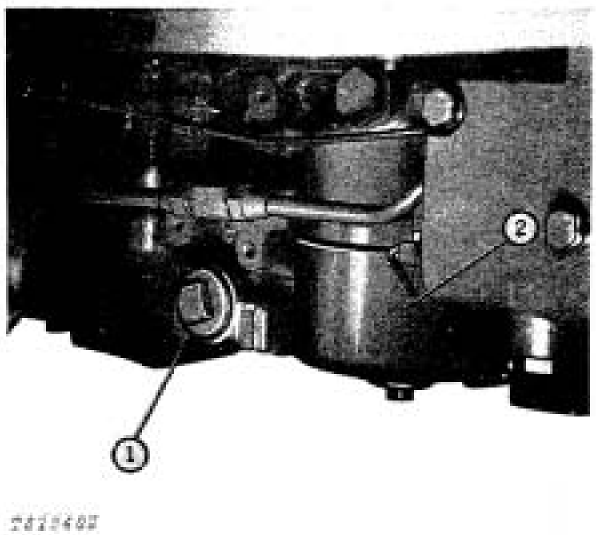
2. Transmission-Hydraulic System Oil Level and Oil Filter Element

NOTE: Before checking oil level find out if customer has changed filter element (first 50 hours service).

If changed at an earlier date, record information below:

Approximate hours at change ______________

If not, change as follows:



1—Intake Screen Cover
2—Transmission-Hydraulic System Oil Filter Cover

Fig. 36-Transmission-Hydraulic Filter

Remove the transmission-hydraulic system oil filter cover and pull out rubber packing and oil filter element. Install new packing in groove in transmission case. Be sure packing is fully seated. Install new filter element and the filter cover. Tighten the filter cover to 55 lb-ft (7.6 kg-m). Do not overtighten.

Check the transmission-hydraulic system oil level.

Run engine 2 to 3 minutes to fill oil circuits. Check oil level with unit on level ground, engine running at slow idle, rockshaft and any equipment lowered, reverser lever locked in neutral, parking brake engaged, if equipped, range shift lever in park, and clutch engaged. First remove dipstick and wipe oil off. Insert dipstick with cap resting on threads of tube (not screwed in place). If oil level is down to bottom mark on dipstick, add oil.

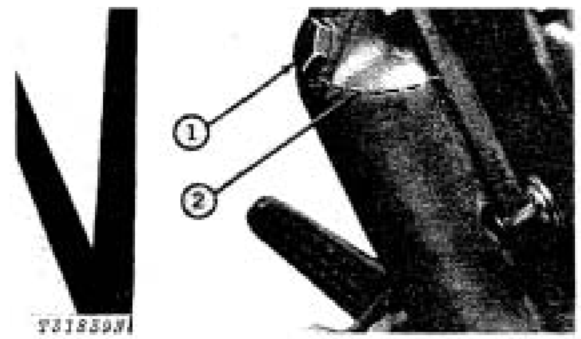
Remove filler cap on rockshaft housing and add oil specified on page 10-15-1 to bring oil level to top mark on dipstick.

Transmission-hydraulic element changed — *Yes* *No*

Transmission-hydraulic oil level checked — *Yes* *No*

3. Manual Steering Oil Level

Check the manual steering oil level.



1—Filler Plug
2—Oil Level

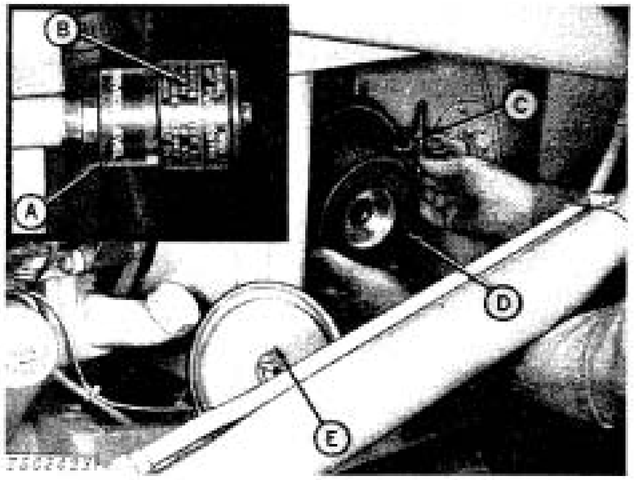
Fig. 37-Manual Steering Oil Level

Remove filler plug. Oil must be to level of filler hole. If necessary, add oil specified on page 10-15-1.

Oil level checked — *Yes* *No*

Oil added — *qts. (L)*

4. Air Cleaner



A—Restriction Indicator
B—Red Signal
C—Wing Nut
D—Element
E—Cover

Fig. 38-Air Cleaner

Check air filter restriction indicator (A). If red signal can be fully seen, remove element (D) and clean. Install a new element if necessary.

Element OK *Yes* *No*

5. Radiator

Check engine coolant level.

CAUTION: Do not remove radiator filler cap unless the engine is cool. Then loosen the cap slowly to the stop to relieve pressure before removing the cap.

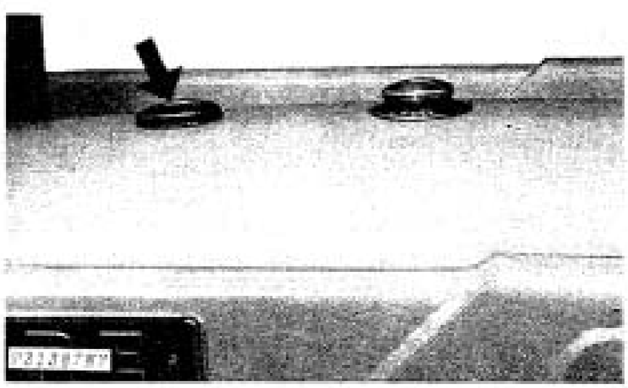


Fig. 39-Radiator Filler Cap

Maintain coolant level midway between the radiator core and the filler neck. If needed add clean soft water for warm weather or a solution of 50% clean water and 50% ethylene glycol (permanent type antifreeze with approved rust inhibitor) for cold weather.

Check cooling system for loose connections and leaks.

Coolant level checked *Yes* *No*

6. Battery

Check battery electrolyte level. If distilled water is not available, use clean soft water. Avoid use of hard water. Remove foreign material from top of battery and coat terminals with petroleum jelly. Check vent holes in battery caps.

IMPORTANT: Never add water to battery in freezing weather unless engine will be run 2 or 3 hours.

Battery checked *Yes* *No*

7. Tire Pressure

Check tire pressure with an accurate gauge having 1 psi (0.07 bar) graduations. Inflate tires according to the chart below.

FRONT TIRE INFLATION

Tire Size	Type	PR	Inflation Pressure: With Towed or Rear-Mounted Equipment	With Light Front-Mounted Equipment	With Heavy Front-Mounted Equipment
6.50-16	I-1	6	36 psi (2.5 bar)	40 psi (2.8 bar)	48 psi (3.3 bar)
7.50/8.00-16	F-3	6	28 psi (1.9 bar)	32 psi (2.2 bar)	36 psi (2.5 bar)
27x9.50-15	I-1	6	35 psi (2.4 bar)	40 psi (2.8 bar)	Do not use
27x9.50-15	I-1	10	55 psi (3.8 bar)	60 psi (4.1 bar)	65 psi (4.5 bar)
11L-15	F-3	8	40 psi (2.8 bar)	40 psi (2.8 bar)	40 psi (2.8 bar)

REAR TIRE INFLATION

Tire Size	PR	Inflation Pressure: With Little Ballast or No Rear-Mounted Equipment	With Moderate Ballast or Light Rear-Mounted Equipment	With Maximum Ballast or Heavy Rear-Mounted Equipment
13.6-28	4	14 psi (1.0 bar)	14 psi (1.0 bar)	Do not use
14.9-24	6	14 psi (1.0 bar)	16 psi (1.1 bar)	18 psi (1.2 bar)
16.9-24	6	18 psi (1.2 bar)	20 psi (1.4 bar)	22 psi (1.5 bar)
17.5L-24	8	24 psi (1.7 bar)	24 psi (1.7 bar)	24 psi (1.7 bar)
18.4-16A	6	14 psi (1.0 bar)	14 psi (1.0 bar)	Do not use

Tire pressure checked *Yes* *No*

8. Fuel Filter

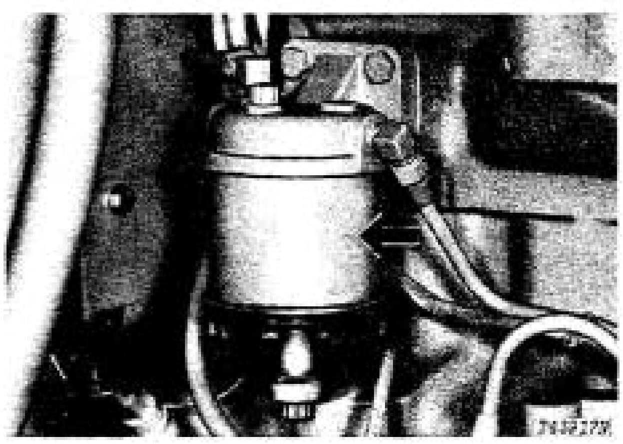


Fig. 40-Fuel Filter

Check fuel filter for sediment. Drain if necessary.

Bleed the Fuel System

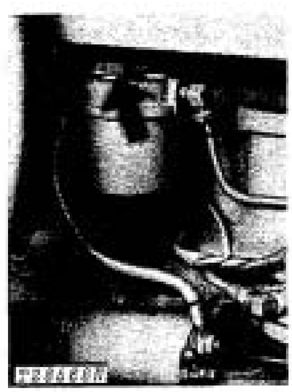


Fig. 41-Bleed Plug

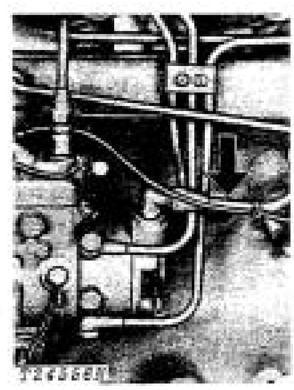


Fig. 42-Inlet Line

1. Loosen bleed plug on top of fuel filter. Pump primer lever until a solid stream of fuel (free of air bubbles) flows from the opening. Tighten plug.

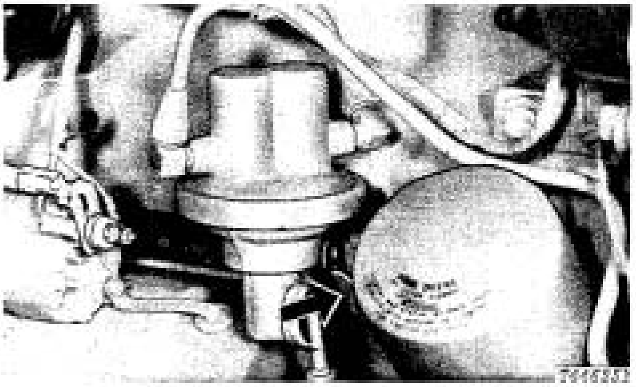


Fig. 43-Primer Lever

2. Loosen pump inlet line. Pump primer lever until a solid stream of fuel (free of air bubbles) flows from line. Retighten line.

3. Be sure to leave primer lever at lowest point of stroke.

Fuel filter drained *Yes* *No*

Fuel system bled *Yes* *No*

9. Fuel Tank Filter

Clean the fuel tank filter.

Open the needle valve (on bottom of fuel tank) to remove fuel from tank. Remove the fuel line from the needle valve. Remove the needle valve and filter. Clean the filter with diesel fuel. Install all parts. Add fuel to tank. Bleed the fuel system. See item 8.

Filter cleaned *Yes* *No*

10. Grease Fittings

Check each fitting shown. Lubricate, if necessary, with John Deere Multi-Purpose Grease or an equivalent.

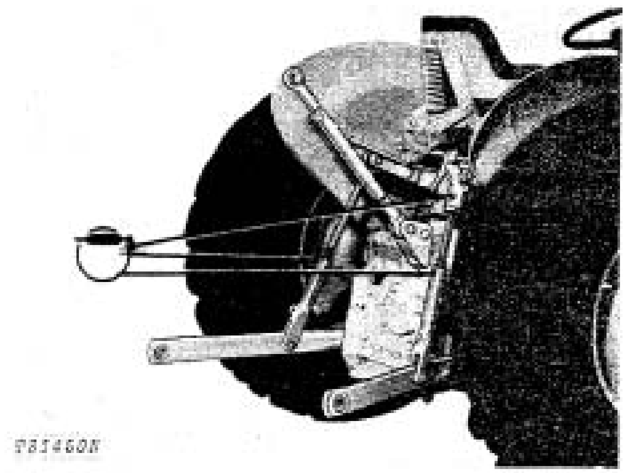


Fig. 44-3-Point Hitch (3 points)

Lubrication required *Yes* *No*

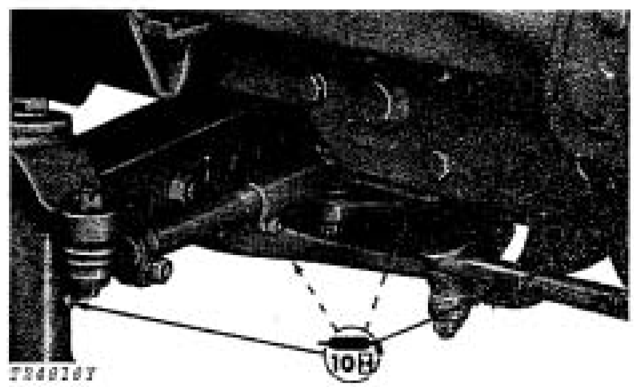


Fig. 45-Front Axle Pivot Points (4 points)

Lubrication required *Yes* *No*

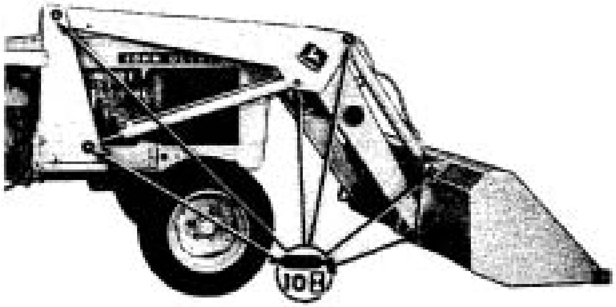


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Fig. 46-Loader Pivot Points (12 points)

Lubrication required *Yes* *No*

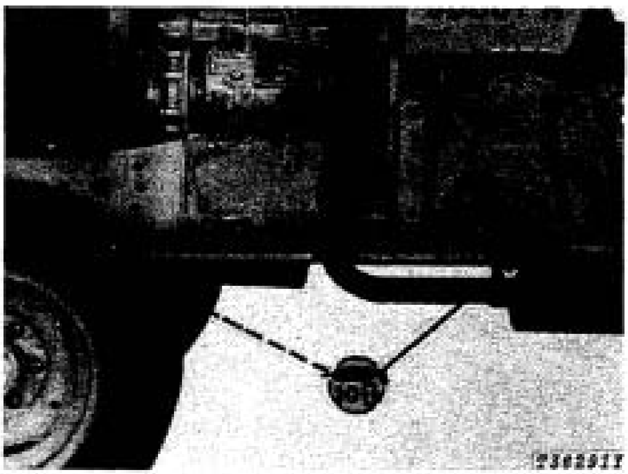


Fig. 47-Drag Links (2 points)

Lubrication required *Yes* *No*

11. Air Intake Hoses

Check clamps on hoses connecting air cleaner and engine. Tighten hose clamps where necessary. Inspect hoses for cracks.

Intake hoses checked *Yes* *No*

12. Alternator-Fan Belt Tension

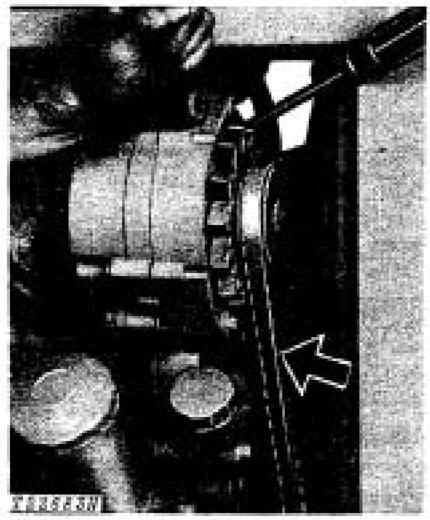


Fig. 48-Alternator-Fan Belt Tension

Check alternator-fan belt tension. Loosen the alternator bracket and adjusting cap screws. Apply outward force to the FRONT alternator frame until 20 pound (9 kg) force on the belt midway between the pulleys will deflect the belt 3/4 inch (19 mm). If a tension gauge is used, strand tension must be 90 lb. (41 kg).

IMPORTANT: Do not pry on the rear of the alternator housing.

Belt tension checked *Yes* *No*

13. Engine Speeds

Check engine speeds.

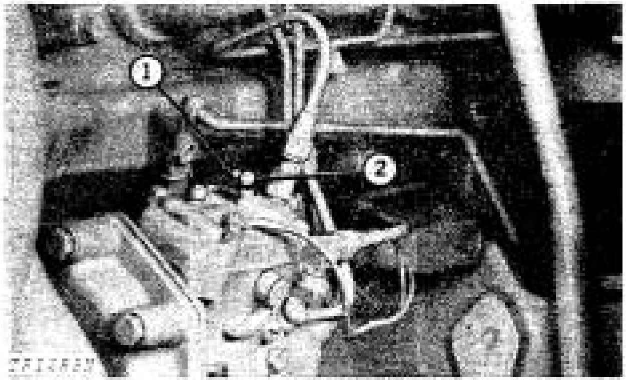
Slow idle - 825 rpm
Fast idle - 2650 rpm hand throttle
2800 rpm foot throttle

Speed Control Adjustment

NOTE: Make all speed control adjustments in the exact order given. Be sure engine is warmed up before making speed adjustments. Attach a master tachometer to check engine speeds.

1. Disconnect speed control rod from injection pump lever and adjust pump fast and slow idle to specifications as follows:

2. Disconnect speed control rod from injection pump arm.



1—Fast Idle Stop Screw **2—Slow Idle Stop Screw**

Fig. 49-Speed Control Adjustments

3. Run engine and rotate pump throttle arm until fast idle stop screw (1, Fig. 49) contacts its stop. Engine speed should be at 2650 rpm fast idle. If not, adjust fast idle stop screw to correct fast idle. Lock screw with sealing wire.

4. Lightly rotate pump throttle arm to slow idle position. Engine speed should be at 800 rpm slow idle. If not, adjust slow idle stop screw (2, Fig. 49) to correct slow idle.

5. Connect speed control rod to injection pump arm. Move hand throttle counterclockwise until pump arm is preloaded to 1/4 inch (6 mm) against its stop. Position slow idle stop screw head (2) against dash and lock with jam nut.

6. Move hand throttle clockwise until fast idle is reached. Position fast idle stop screw head against dash and secure with lock nut.

7. Adjust foot throttle rod so that pump lever is preloaded 1/4 inch (6 mm) when engine is running at 2800 rpm.

Engine speeds checked *Yes* *No*

14. Indicator Lights and Gauges

Check operation of indicator lights.

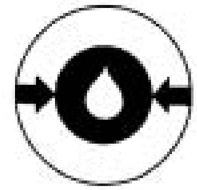


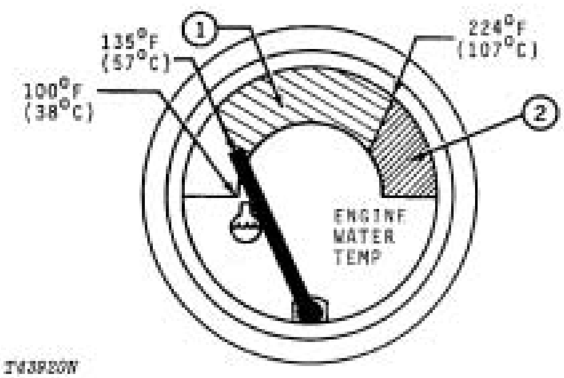
Fig. 50-Engine Oil Pressure Indicator Light

If light glows red when engine is running, stop engine immediately and determine cause.

Fig. 51-Alternator Indicator Light

Light glows red when alternator is not charging. When light goes on with engine running, stop engine and determine cause.

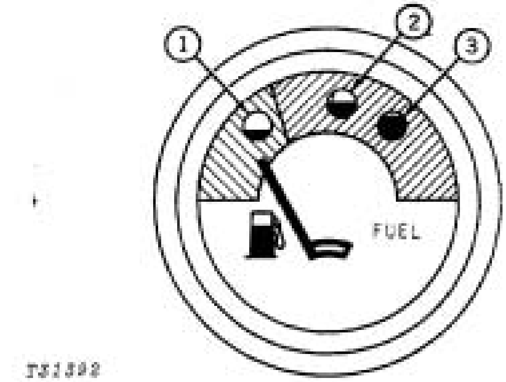
Check operation of gauges.



1—Operating Range **2—Red-Orange Zone**

Fig. 52-Coolant Temperature Gauge

If the indicator hand goes into the red-orange zone, stop the engine. Check the cooling system.



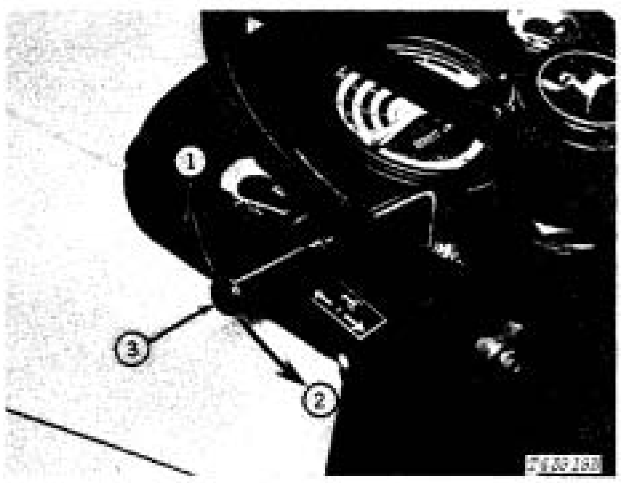
1—Empty Tank
2—Half Full Tank
3—Full Tank

Fig. 53-Fuel Gauge

Add a small amount of fuel to the fuel tank. Check the action of the fuel gauge.

Indicator lights and gauges checked Yes No

15. Reverser



1—Forward
2—Reverse
3—Neutral

Fig. 54-Reverser Lever

The reverser unit allows the operator to change the direction of travel "on the go" without declutching or shifting gears.

Note and correct any reverser malfunctions.

Check the reverser speed-of-shift time. Total time must be 3/4 to 1-1/4 seconds. Make the speed-of-shift as smooth as possible.

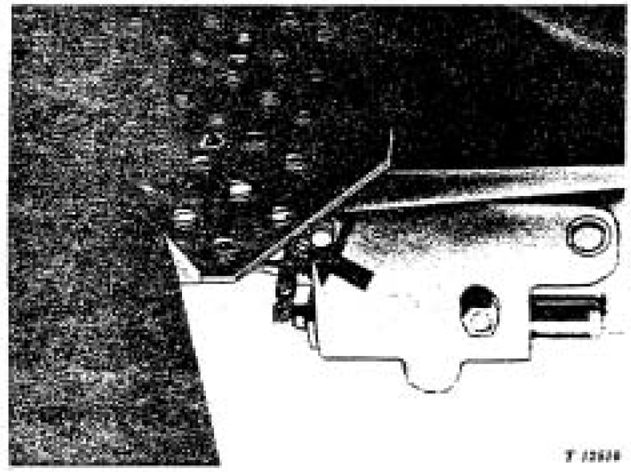


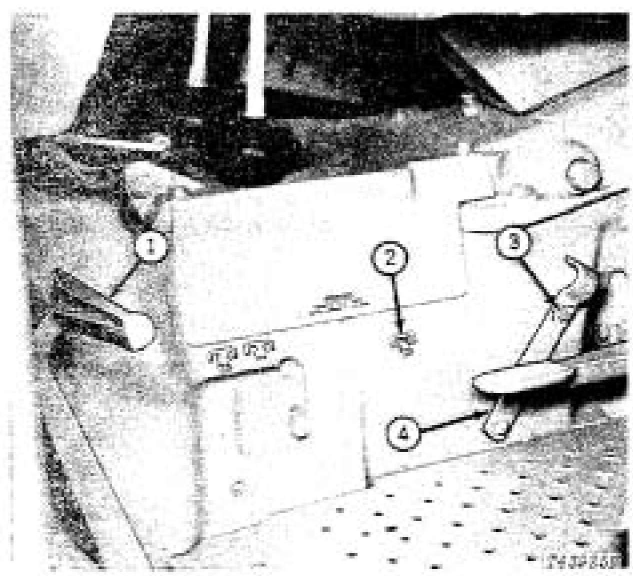
Fig. 55-Reverser Speed-Of-Shift Adjusting Screw

Turn the adjusting screw clockwise to slow down the shift. Turn the screw counterclockwise to speed up the shift. Turn the screw one-fourth turn at a time until the desired speed-of-shift is obtained.

Reverser operation checked Yes No

16. Power Take-Off

Check power take-off operation.



1—PTO Clutch
2—On
3—Off
4—PTO Lever

Fig. 56-PTO Operation

IMPORTANT: **Disengage PTO clutch at pedal before shifting PTO selector lever. PTO lever must be in fully engaged or "ON" position to avoid excessive spline wear.**

Continuous-Running PTO

To engage the PTO, completely depress the clutch pedal (momentarily wait for machine motion to stop) and move the PTO selector lever to the "ON" position. Slowly engage the clutch pedal.

To disengage the PTO, completely depress the clutch pedal. Shift the selector lever to the "OFF" position.

IMPORTANT: Always disconnect rear PTO stub shafts when not in use.

PTO operation checked *Yes* *No*

17. Differential Lock

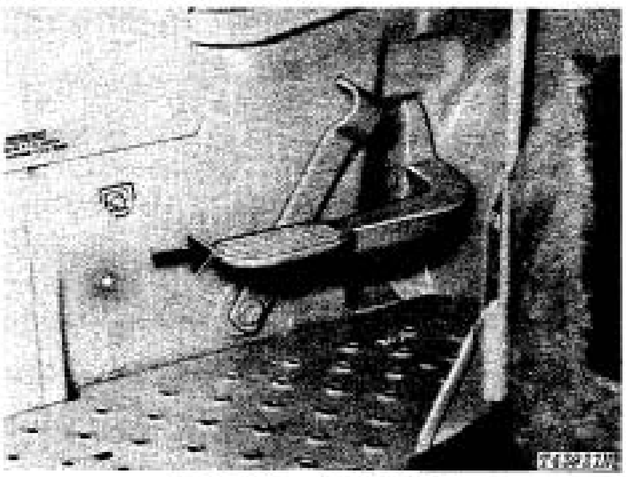


Fig. 57-Differential Lock Pedal

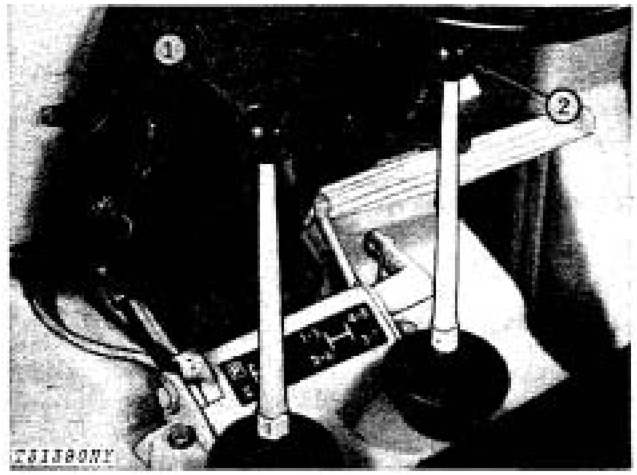
Check the differential lock operation.

While driving straight ahead, push down the differential lock pedal. Hold the pedal down. Turn the steering wheel slightly. There will be steering resistance if differential lock is working correctly.

The differential lock will automatically disengage when the pedal is released if traction for both rear wheels is equal. Unequal traction will keep the lock engaged.

Differential lock checked *Yes* *No*

18. Transmission Shifting



1—Range Shift Lever **2—Gear Shift Lever**

Fig. 58-Transmission

Check the operation of the unit in all ranges and gears.

Correct any malfunctions.

Transmission shifting checked *Yes* *No*

19. Brakes

Check operation of brakes.

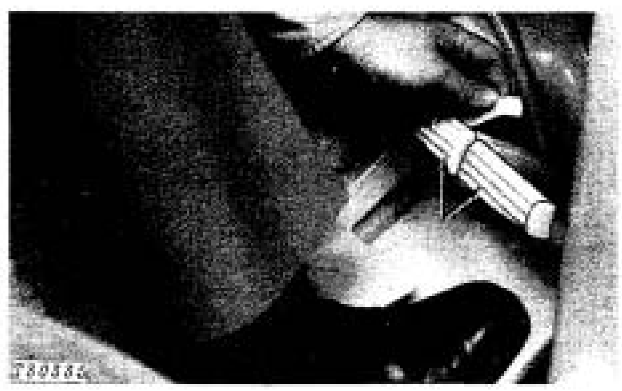


Fig. 59-Hydraulic Brakes

When stopping, push down both brake pedals. The machine must not pull to one side when stopping.

Turn to the left (L.H.). Push down the left (L.H.) brake pedal as you turn. Turn to the right (R.H.). Push down the right (R.H.) pedal as you turn.

The operator must feel the braking action pulling the machine to the left (L.H.) or right (R.H.). Brake action must be the same for both brakes.

Bleeding Brakes

Whenever braking action is poor or erratic, or pedal action feels spongy, bleed the hydraulic brakes.

To bleed the brakes, start the engine and run it at 2000 rpm with clutch engaged for at least two minutes. This will permit the brake valve reservoir to fill with oil.

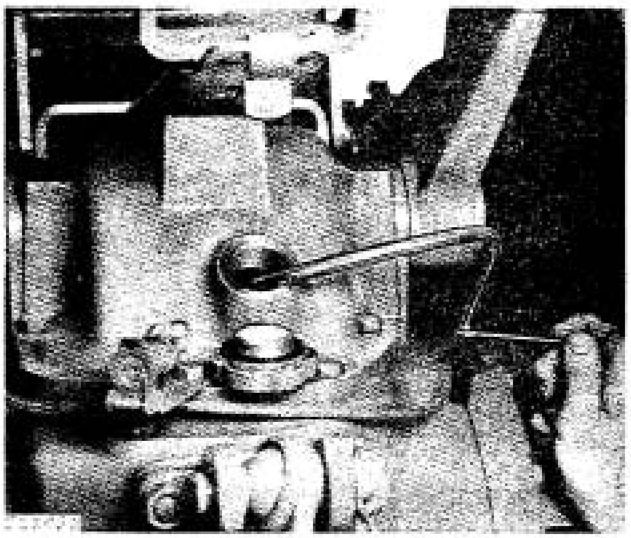


Fig. 60-Bleeding Brakes

Attach a transparent bleeder tube to the brake bleed screw located on top of the rear axle housing. Allow the tube to hang submerged in transmission oil through the filler hole as shown.

Turn bleed screw counterclockwise 3/4 turn. Slowly depress brake pedal on brake being bled. Allow it to return slowly. Continue operating pedal until oil in tube is free of air bubbles.

With brake pedal depressed, tighten bleed screw.

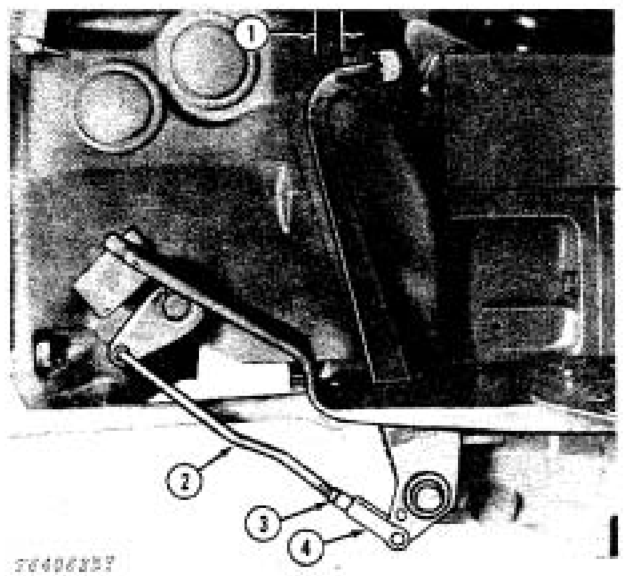
Remove bleeder tube. Repeat operation on other brake.

Brakes checked	*Yes*	*No*
Brakes bled	*Yes*	*No*

20. Clutch Pedal Free Travel

Without Reverser (with continuous PTO)

Check the free travel of the clutch pedal.



1—Specified Free Travel
2—Clutch Rod
3—Jam Nut
4—Yoke

Fig. 61-Clutch Pedal Free Travel (Without Reverser)

Free travel measured at the pedal pad (1, Fig. 61) must be 1/2 in. (13 mm) to 1 in. (25 mm).

IMPORTANT: Do not operate the machine when the free travel of the clutch pedal is less than 1/2 inch (13 mm).

If adjustment is needed, remove the yoke (4, Fig. 61) from the pedal. Loosen the jam nut (3). Turn the yoke until adjustment is about 3/4 in. (19 mm). Tighten the jam nut.

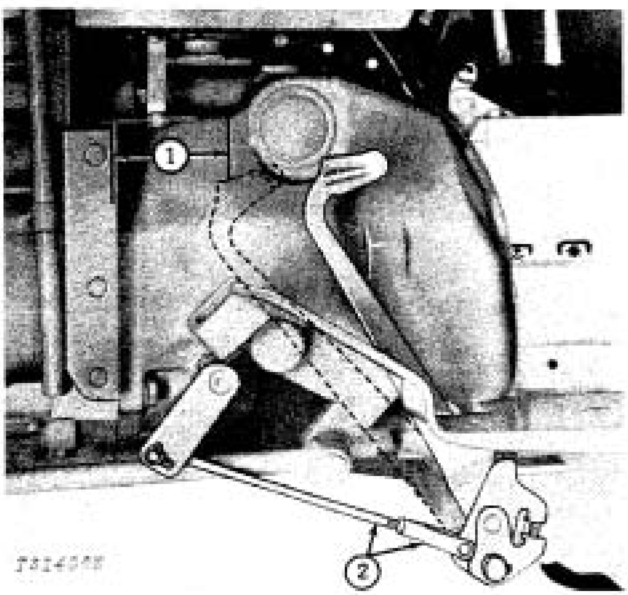
Without Reverser (with no PTO or with independent PTO)

Push the clutch pedal down until the clutch fingers contact the throwout bearing. Measure the distance from the pedal arm to where the pedal arm contacts the pedal stop. This distance must be 5 in. (127 mm).

If adjustment is needed, turn the yoke on the clutch rod until the distance is 5 in. (127 mm).

With Reverser

Check the rod adjustment of the fork shaft.



1—5-1/4 Inches (133 mm) to 5-3/4 (146 mm)
2—Fork Shaft Rod and Yoke

Fig. 62-Clutch Pedal Free Travel (With Reverser)

Push the pedal down to the bottom of the first stage.

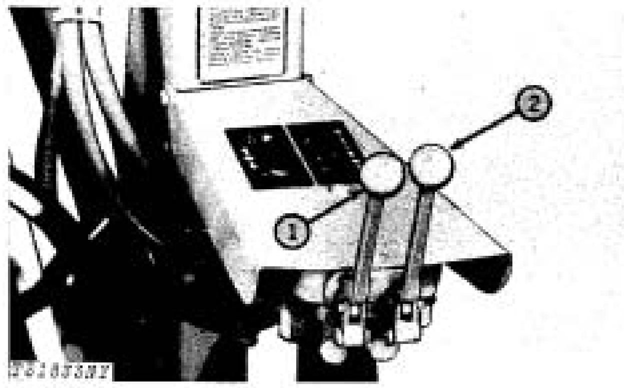
In this position the throwout bearing will be against the clutch fingers. The top right (R.H.) edge of the rear of the pad of the clutch pedal must be 5-1/4 in. (133 mm) to 5-3/4 in. (146 mm) from the front of the bolting flange of the clutch housing. See 1, Fig. 62.

If adjustment is needed, remove the yoke (2, Fig. 62) from the pedal arm. Loosen the jam nut. Turn the yoke on the rod of the fork shaft until the adjustment (1) is about 5-1/2 in. (140 mm). Tighten the jam nut.

Clutch pedal checked Yes No

21. Loader Control Levers

Check the operation of the loader control levers.



1—Bucket Control Lever **2—Boom Control Lever**

Fig. 63-Loader Control Levers

CAUTION: Reduce boom lift speed when raising loaded bucket to full height.

Boom Lever

Push the lever forward to lower the boom. Pull the lever rearward to raise the boom.

If the lever is released during normal loader operation, it will return to neutral and the boom will be held in the position reached at that time.

Push the boom control lever all the way forward for float position. The lever will stay in this position until it is manually returned to neutral.

Bucket Lever

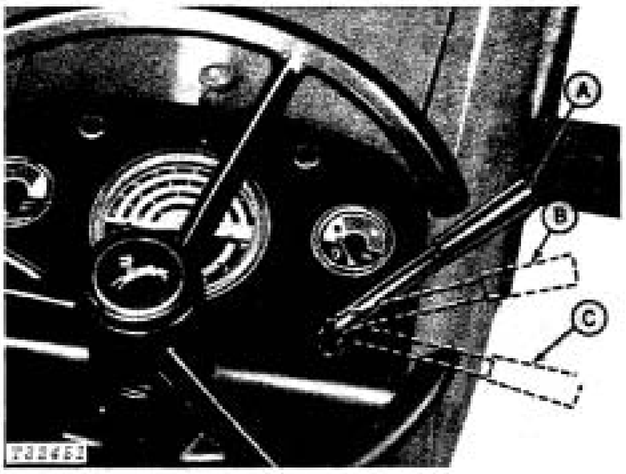
Push the lever forward to dump the bucket. Pull the lever rearward to retract the bucket.

If the lever is released, it will return to neutral and the bucket will be held in the position reached at that time.

Loader control levers checked Yes No

22. Hand Throttle

Check the operation of the hand throttle.



A—Slow Idle
B—PTO Speed
C—Fast Idle

Fig. 64-Hand Throttle

Hand throttle checked *Yes* *No*

23. Lights

Check the operation of the lights.

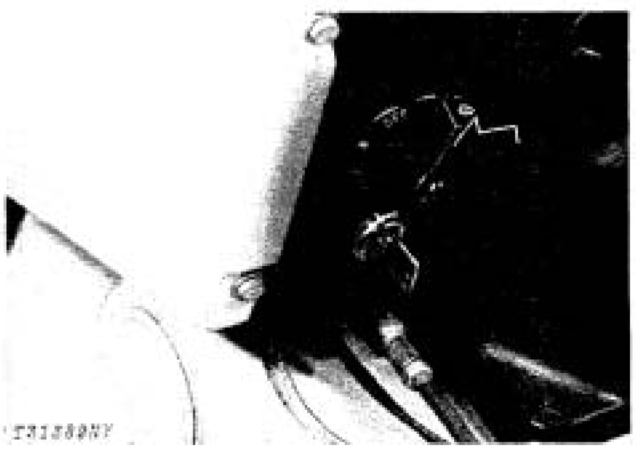


Fig. 65-Light Switch

Position	Headlights	Warning Lamps	Rear Combination Light
OFF	Off	Off	Off
W		On	
F	Dim		White
H	Bright	On	Red
H2	Dim	On	Red

NOTE: If customer desires, wire the lights to turn on when the key switch is off. Remove the purple wire from the "BAT" terminal. Install the unused red wire coming from the circuit breaker. Tape the end of the purple wire.

All lights checked *Yes* *No*

24. Parking Brake

Check the operation of the parking brake.

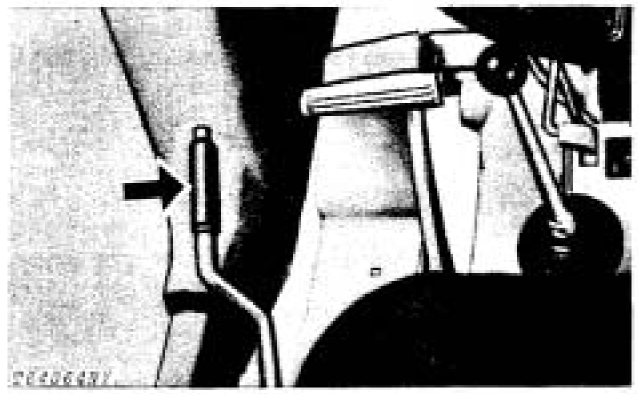
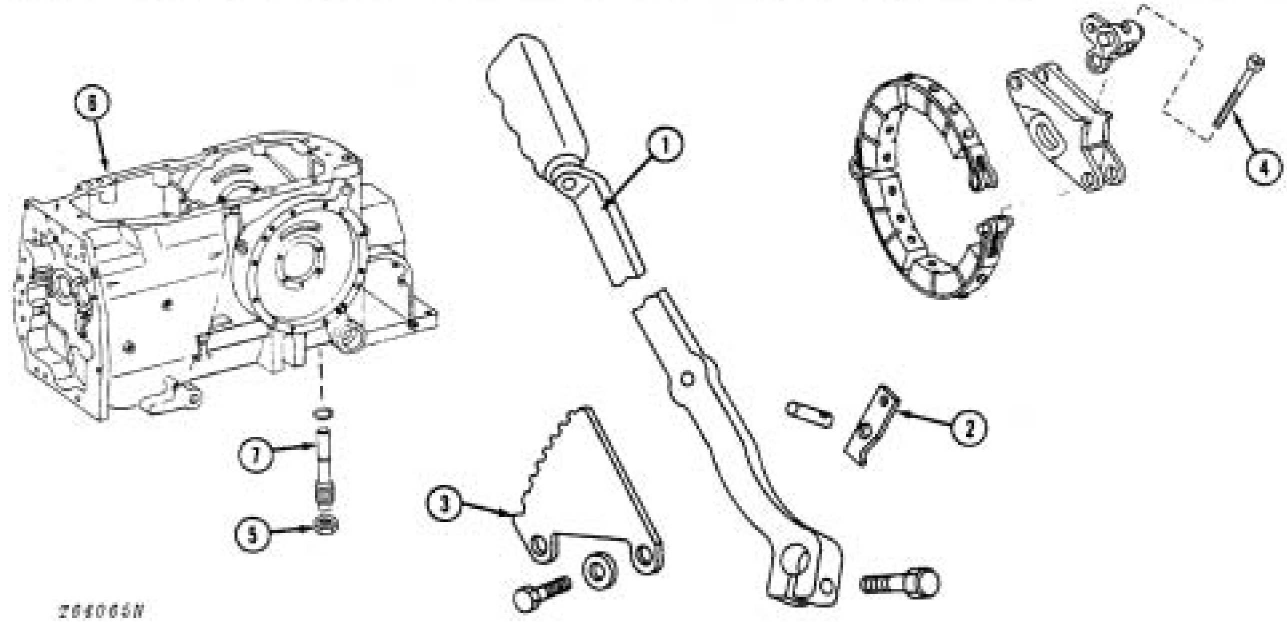


Fig. 66-Parking Brake

1. To engage, pull up.
2. To disengage, press button and push lever down.

If adjustment is needed, follow the procedure on page 10-10-25.



1—Brake Lever
2—Pawl
3—Notched Quadrant
4—Set Screw
5—Jam Nut
6—Transmission Case
7—Stop Screw

Fig. 67-Parking Brake Adjustment

Pull up the brake lever (1, Fig. 67) until the pawl (2) is in the first notch above the long tooth (3).

Tighten the set screw (4) by hand.

Loosen the jam nut (5) on the bottom left (L.H.) side of the transmission case (6).

Tighten the stop screw (7) of the brake band by hand. Loosen this stop screw two turns.

Tighten the jam nut (5).

Parking brake checked *Yes* *No*

25. Spark-Arresting Muffler

Remove pipe plug from bottom of muffler. Run engine for several minutes until exhaust debris is cleaned out. Install plug.

Muffler cleaned out *Yes* *No*

26. Engine Crankcase Vent Tube

Remove the vent tube. Clean it with diesel fuel. Install the vent tube. Be sure the packing fits correctly in the tappet cover.

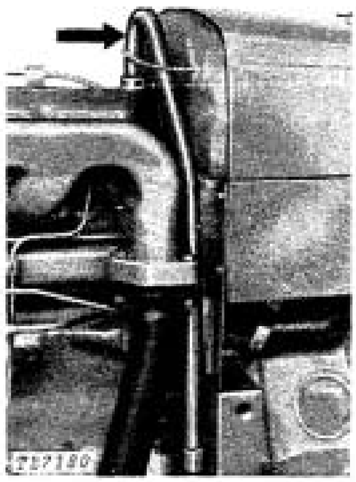


Fig. 68-Crankcase Vent Tube

Vent tube cleaned *Yes* *No*

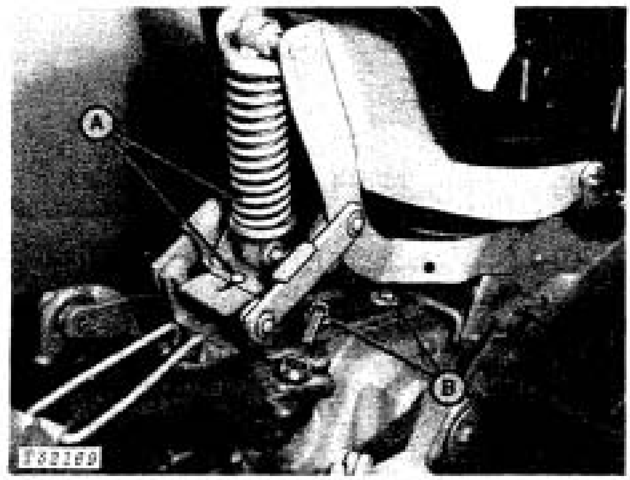
27. Seat

Check the operation of the seat.

Fig. 69-Seat Release Latch (Deluxe Seat)

To move the seat to the upper rear position for standing, lift the release latch (Fig. 69). Stand. Lift the seat to the upper rear position.

To move the seat back to normal position, pull the seat forward. The seat will automatically go back to normal position when you sit.



A—Weight Adjustment **B—Height Adjustment**

Fig. 70-Seat Adjustments

To change the adjustment for the height of the seat, loosen the cap screws (B, Fig. 70). Slide the seat to the desired position. Tighten the cap screws thoroughly.

To change the adjustment for the weight of the operator, move the seat to the upper rear position. Loosen the wing nuts under the support for the shock absorber. Slide the support to the desired position. Tighten the wing nuts.

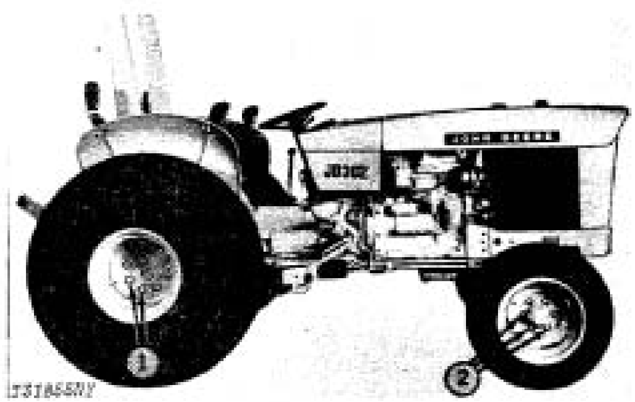
Seat operation checked *Yes* *No*

28. Power Steering

Check the operation of the power steering. The steering wheel must turn freely in both directions without seizure or too much play.

Power steering checked *Yes* *No*

29. Wheel Retainers



1—Rear Wheel Retainer **2—Front Wheel Retainer**

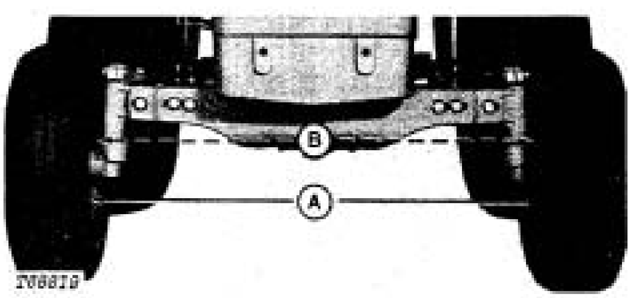
Fig. 71-Wheel Retainers

Tighten front and rear wheel retainers to 100 lb-ft (14 kg-m).

Wheel retainers checked *Yes* *No*

30. Toe-In

Check the front wheel toe-in.



A—Distance Between Front of Rims **B—Distance Between Rear of Rims**

Fig. 72-Checking Toe-In

1. Use down pressure of loader bucket to raise front wheels. Turn wheels so each valve stem is at bottom of tire.

2. Lower wheels to ground.

3. Measure from ground to hub.

4. Mark this distance on inside of each rim at the bead of tire front (A) and rear (B).

5. Measure distance between rims at front and rear marks.

6. Distance between front of rims must be 1/8 to 3/8 in. (3 to 9.5 mm) less than distance between rear of rims.

If distance in step 6 is not correct, change toe-in as follows:

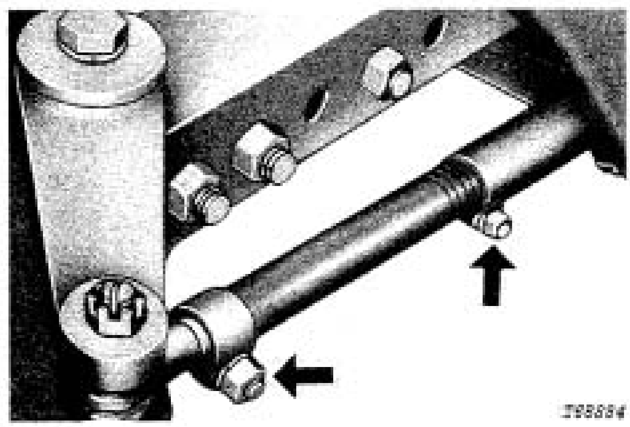


Fig. 73-Cap Screws (Swept Back Axle)

1. Loosen cap screws (Fig. 73).

2. Turn each tie rod the same number of turns until toe-in distance is correct.

3. Be sure tie rod ends are equal in length.

4. The tie rod slot must be turned to the rear.

5. Tighten cap screws to 40 lb-ft (54 Nm).

NOTE: Solid axle tie rods have four clamps.

Toe-in checked *Yes* *No*

31. Fluid Leakage

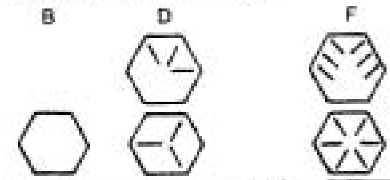
Check the following systems for leakage due to poor or faulty connections and broken hoses or lines.

A. Cooling system checked	*Yes*	*No*
B. Hydraulic system checked	*Yes*	*No*
C. Transmission system checked	*Yes*	*No*
D. Fuel system checked	*Yes*	*No*

32. Accessible Hardward Torque Values

Check all accessible bolts and nuts for proper tightness. If hardware seems loose, tighten it to the proper torque. The table below gives correct torque values for various bolts and cap screws. Most hardware used is high-strength (note dashes on hex. heads).

RECOMMENDED TORQUE IN LB-FT |Kg-m|
COARSE AND FINE THREADS



Bolt Diameter	Plain Head	Three Dashes	Six Dashes
1/4	Not used	10|1.4|	14|1.9|
5/16	Not used	20|2.8|	30|4.1|
3/8	Not used	35|4.8|	50|6.9|
7/16	35|4.8|	55|7.6|	80|11.1|
1/2	55|7.6|	85|11.8|	120|16.6|
9/16	75|10.4|	130|18.0|	175|24.2|
5/8	105|14.5|	170|23.5|	240|33.2|
3/4	185|25.6|	300|41.5|	425|58.8|
7/8	160|22.1|	445|61.5|	685|94.7|
1	250|34.6|	670|92.5|	1030|142.4|
1-1/8	330|45.6|	910|125.8|	1460|201.9|
1-1/4	480|66.4|	1250|172.8|	2060|284.8|

T30882

Fig. 74-Torque Chart

The types of bolts and cap screws are identified by head markings as follows:

Plain Head: regular machine bolts and cap screws.

3-Dash Head: tempered steel high-strength bolts and cap screws.

6-Dash Head: tempered steel extra high-strength bolts and cap screws.

Machine bolts and cap screws 7/8-inch (22 mm) and larger are sometimes formed hot rather than cold, which accounts for the lower torque.

Tighten to standard torque unless specified otherwise.

All accessible hardware torqued	*Yes*	*No*

28. Engine Crankcase Vent Tube

Remove the vent tube. Clean it with diesel fuel. Install the vent tube. Be sure the packing fits correctly in the tappet cover.

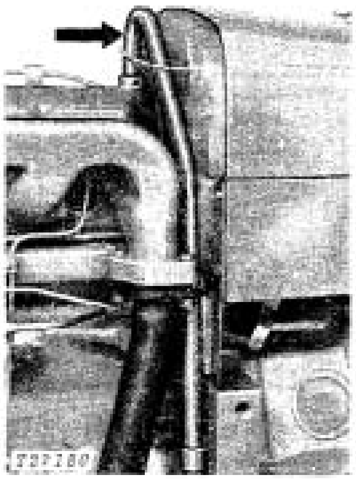


Fig. 73-Crankcase Vent Tube

Vent tube cleaned Yes No

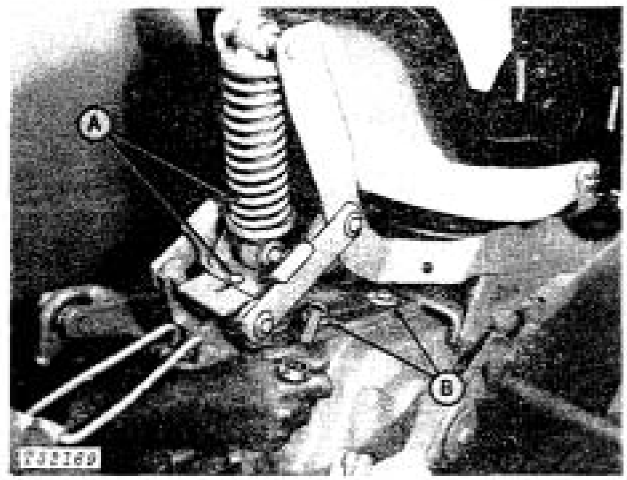
29. Seat

Check the operation of the seat.

Fig. 74-Seat Release Latch (Deluxe Seat)

To move the seat to the upper rear position for standing, lift the release latch (Fig. 74). Stand. Lift the seat to the upper rear position.

To move the seat back to normal position, pull the seat forward. The seat will automatically go back to normal position when you sit.



A—Weight Adjustment **B—Height Adjustment**

Fig. 75-Seat Adjustments

To change the adjustment for the height of the seat, loosen the cap screws (B, Fig. 75). Slide the seat to the desired position. Tighten the cap screws thoroughly.

To change the adjustment for the weight of the operator, move the seat to the upper rear position. Loosen the wing nuts under the support for the shock absorber. Slide the support to the desired position. Tighten the wing nuts.

Seat operation checked Yes No

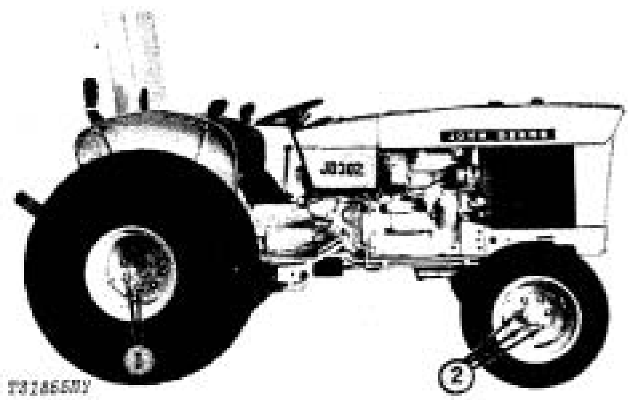
30. Power Steering

Check the operation of the power steering. The steering wheel must turn freely in both directions without seizure or too much play.

Power steering checked Yes No

31. Wheel Retainers

Check the bolt torque of the wheel retainers.



1—Rear Wheel Retainer 2—Front Wheel Retainer

Fig. 76-Wheel Retainers

Tighten front and rear wheel retainers to 100 lb-ft (14 kg-m).

Wheel retainers checked Yes No

32. Fluid Leakage

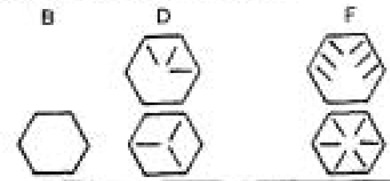
Check the following systems for leakage due to poor or faulty connections and broken hoses or lines.

A. Cooling system checked Yes No
B. Hydraulic system checked Yes No
C. Transmission system checked Yes No
D. Fuel system checked Yes No

33. Accessible Hardware Torque Values

Check all accessible bolts and nuts for proper tightness. If hardware seems loose, tighten it to the proper torque. The table below gives correct torque values for various bolts and cap screws. Most hardware used is high-strength (note dashes on hex. heads).

RECOMMENDED TORQUE IN LB-FT |Kg-m|
COARSE AND FINE THREADS



Bolt Diameter	Plain Head	Three Dashes	Six Dashes
1/4	Not used	10|1.4|	14|1.9|
5/16	Not used	20|2.8|	30|4.1|
3/8	Not used	35|4.8|	50|6.9|
7/16	35|4.8|	55|7.6|	80|11.1|
1/2	55|7.6|	85|11.8|	120|16.6|
9/16	75|10.4|	130|18.0|	175|24.2|
5/8	105|14.5|	170|23.5|	240|33.2|
3/4	185|25.6|	300|41.5|	425|58.8|
7/8	160|22.1|	445|61.5|	685|94.7|
1	250|34.6|	670|92.5|	1030|142.4|
1-1/8	330|45.6|	910|125.8|	1460|201.9|
1-1/4	480|66.4|	1250|172.8|	2060|284.8|

T30883

Fig. 77-Torque Chart

The types of bolts and cap screws are identified by head markings as follows:

Plain Head: regular machine bolts and cap screws.

3-Dash Head: tempered steel high-strength bolts and cap screws.

6-Dash Head: tempered steel extra high-strength bolts and cap screws.

Machine bolts and cap screws 7/8 inch (22 mm) and larger are sometimes formed hot rather than cold, which accounts for the lower torque.

Tighten to standard torque unless specified otherwise.

All accessible hardware torqued Yes No

LUBRICANTS

Use only lubricants specified in this section. Apply them according to instructions in the operator's manual.

ENGINE LUBRICATING OILS

Z2377

John Deere TORQ-GARD SUPREME® Engine Oil is recommended in engine crankcase. Never put additives in crankcase.

If oil other than TORQ-GARD SUPREME is used, it must conform to following specifications.

SINGLE VISCOSITY OILS	MULTI-VISCOSITY OILS
API Service CD-SD MIL-L-2104C Series 3	API Service CC/SD MIL-L-46152

Use oil of viscosity as shown in following chart.

Air Temperature	John Deere TORQ-GARD SUPREME	Other Oils: Single Viscosity Oil	Other Oils: Multi-Viscosity Oil
Above 32°F (0°C)	SAE 30	SAE 30	Not recommended
−10°F to 32°F (−23°C to 0°C)	SAE 10W-20	SAE 10W	SAE 10W-30
Below −10°F (−23°C)	SAE 5W-20*	SAE 5W	SAE 5W-20

**SAE 5W-20 oil may also be used to insure optimum lubrication at starting, particularly when engine is subjected to −10°F (−23°C) or lower temperatures for several hours.*

Some increase in oil consumption may be expected when SAE 5W-20 or SAE 5W oils are used. Check oil level more frequently.

TRANSMISSION-HYDRAULIC OILS

Use John Deere HY-GARD® Transmission and Hydraulic Oil (J20A) or an equivalent.

GREASES

Use John Deere Multi-Prupose Grease or equivalent for all grease fittings and front wheel bearings.

Section 20
ENGINE

CONTENTS OF THIS SECTION

CONTENTS OF THIS SECTION—Continued

Group 5
ENGINE REMOVAL AND INSTALLATION
REMOVAL

Most service procedures on the engine can be accomplished with the engine in the tractor. If the crankshaft is to be removed or in the event of a general overhaul, remove the engine.

Remove the front end support with radiator, fuel tank and main hydraulic pump as instructed in Section 60, Group 5.

Disconnect battery ground straps for safety.

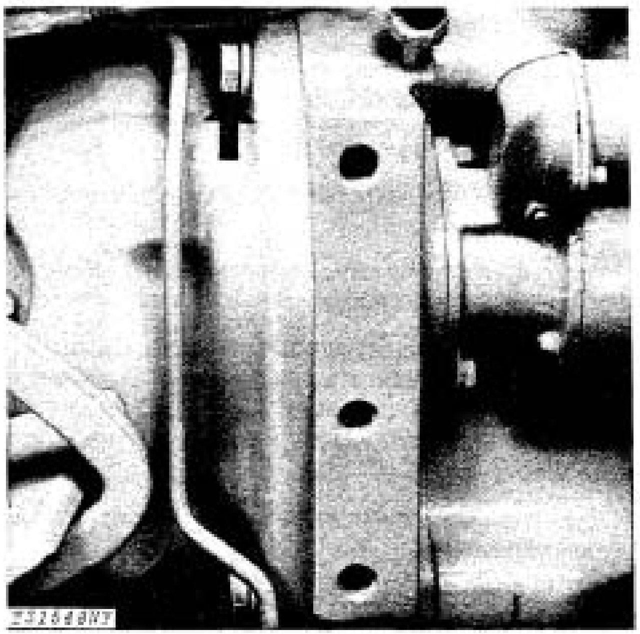


Fig. 1-Engine Attaching Points, Right Side

Disconnect front wiring harness from alternator lead. Also disconnect fuel gauge sender lead.

Remove battery cable and wiring harness from starter solenoid.

Disconnect wiring harness at oil pressure sending unit and at ignition coil (gasoline).

Disconnect and remove tachometer cable from right rear of engine. Remove rubber gasket from tachometer cable (gasket may remain in clutch housing). Replace gasket if damaged.

On diesel engines, disconnect starting fluid line from air intake manifold.

Disconnect pressure line from connection on power steering valve.

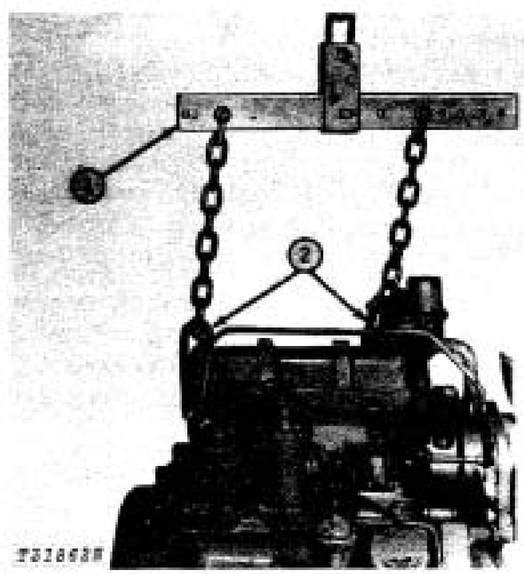
Free hydraulic reservoir bleed line from clamps at top of rocker arm cover.

Disconnect throttle rod from carburetor (gasoline) or fuel injection pump (diesel). Also disconnect choke cable from carburetor on gasoline engines.

Remove water temperature sending unit from water outlet manifold.

Remove battery from cowl. Remove cap screws securing front of cowl to flywheel housing.

Disconnect rear exhaust muffler from manifold (if equipped).



1—JDG-1 or JDG-23 Engine Lifting Sling
2—JD-244 Lifting Eyes

Fig. 2-Removing Engine

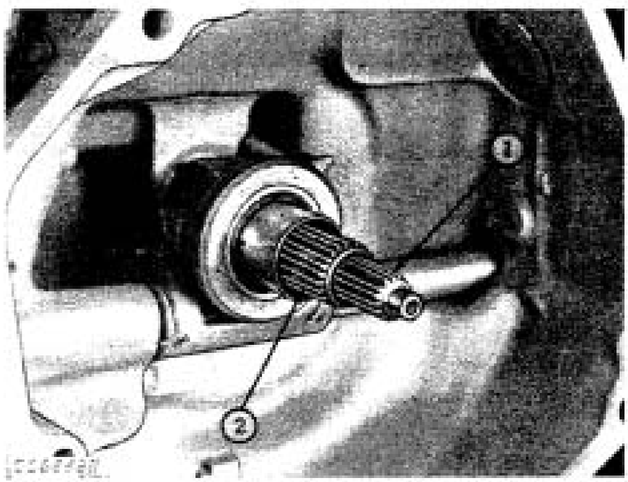
Install two JD-244 Lifting Eyes (or JDG-19 Lifting Bracket) on cylinder head (Fig. 2).

Support JDG-1 or JDG-23 Engine Lifting Sling on a hoist and attach to adapters as shown in Fig. 2. D01043AA Load Positioning Sling may be used in place of JDG-1 or JDG-23.

Remove cap screws securing clutch housing to engine block and also two oil pan to clutch housing cap screws.

Using hoist, pull engine forward off clutch housing mount. Remove engine from tractor.

INSTALLATION



1—Transmission Clutch Shaft
2—Powershaft Clutch Shaft

Fig. 3-Transmission and Powershaft Clutch Shafts Indexing Points (Tractors Equipped with PTO)

On tractors equipped with continuous PTO, the indexing of the powershaft clutch shaft with the PTO driven disk takes place before the indexing of the transmission clutch shaft with the transmission driven disk as shown in Fig. 3. Due to the time delay during indexing, it is possible that the transmission clutch shaft might not index with the transmission drive disk. This will result in breakage of the driven disk and pressure plate.

To install engine correctly, line up cap screw holes of the engine with those of the clutch housing. Bar engine over, holding in a horizontal position and exerting a steady pressure on the engine toward the clutch housing.

IMPORTANT: Be sure engine flywheel housing is securely against clutch housing before drawing up cap screws.

Tighten engine-to-clutch housing cap screws to 250 lb-ft (34.56 kg-m). Remove engine sling.

Secure front inside of cowl to engine flywheel housing with attaching cap screws. Install battery in cowl.

Connect throttle rod to carburetor (gasoline) or to fuel injection pump (diesel). Also connect choke cable to carburetor on gasoline engines.

Connect water temperature sending unit to water outlet manifold.

Connect rear exhaust muffler (if equipped).

Connect front wiring harness to alternator lead. Also connect fuel gauge sender lead.

Connect battery cable and wiring harness lead to starter solenoid.

Connect wiring harness to oil pressure sending unit and to ignition coil (gasoline).

Coat tachometer cable gasket with Lubriplate or equivalent and install on cable. Index slot in cable to coupler and tighten so that no oil leaks from around cable. Do not tighten too tight or gasket will be damaged and oil leaks will form.

On diesel engines, connect starting fluid line to air intake manifold.

Join the front end support with radiator, fuel tank and main hydraulic pump as instructed in Group 10, Section 50.

IMPORTANT: Install front support end of side grille retaining spring with open end of hook facing front of tractor.

Connect power steering pressure line to connector at accumulator.

Connect battery ground straps.

IMPORTANT: Batteries are NEGATIVE grounded only. Do not polarize the alternator as this will damage the electrical system.

Group 10
BASIC ENGINE

GENERAL INFORMATION

The cylinder head holds the rocker arm assembly, valve springs, and valves.

Valve guides and seats are integral with the cylinder head.

Intake and exhaust valves in diesel engines have replaceable wear caps. Gasoline exhaust valves have valve rotators.

The camshaft is iron alloy with all cams integral. The gasoline engine camshaft is cast with an integral distributor drive gear. Both the gasoline and diesel engine camshafts have a lobe to actuate the fuel transfer pump.

The camshaft is driven at one-half engine speed by the top idler gear and is supported by three pressure-lubricated bores integral with the cylinder block. Camshaft thrust is taken by a thrust plate fastened to the front of the cylinder block.

Cylinder block and crankcase are cast in one piece.

Cylinder liners are of the replaceable wet-sleeve type, made of hardened alloy cast iron and are a slip fit in the cylinder block. The flange of each liner rests on a shoulder within the block and is sealed by a square rubber packing. The top edge of the liner is sealed flush with the cylinder block by the compression of the cylinder head and gasket. Two O-rings in the block provide additional sealing.

Pistons are aluminum-alloy, cam-ground and weight controlled, with two compression rings and one oil control ring.

Connecting rods have a replaceable bronze bushing for the piston pin and a replaceable, steelbacked, aluminum-lined bearing insert.

The crankshaft is a one-piece steel forging, and is supported on main bearings. The bearings are replaceable, steel-backed, tin-plated, aluminum-lined inserts. The rear main bearing has a thrust surface.

The crankshaft is drilled for pressure lubrication from the main bearings to connecting rod bearings.

The ring gear for the starting motor is shrunk in place on the front outer rim of the flywheel. On the front outer rim of the flywheel is a "TDC" (top dead center) bore that is used when timing injection pump, and adjusting valve tappets.

The crankshaft gear drives the gear train located at the front of the engine. The upper idler gear transmits power from the crankshaft gear to drive the camshaft gear and the injection pump or governor drive gear. The lower idler gear drives the oil pump gear.

CYLINDER HEAD AND VALVES

VALVE LIFT CHECK

Fig. 1-Checking Valve Lift

Measuring valve lift can give an indication of wear on cam lobes, cam followers, and push rods.

Set exhaust valve clearance of 0.018 inch (0.46 mm) for diesel and 0.022 inch (0.56 mm) for gasoline and intake valve clearance of 0.014 inch (0.36 mm) for both diesel and gasoline.

Place dial indicator on valve rotator or valve spring cap. (Be sure that valve is fully closed and the rocker arm moves freely.) Zero dial indicator.

Manually turn engine in running direction. When rocker arm contacts valve, check indicator travel as the rocker arm moves valve to full open.

Exhaust valve lift should be 0.456 to 0.482 inch (11.58 to 12.24 mm) for diesel and 0.452 to 0.482 inch (11.48 to 12.24 mm) for gasoline and intake valve lift should be 0.460 to 0.490 inch (11.68 to 12.45 mm) for both diesel and gasoline.

REMOVAL

The engine need not be removed to service cylinder head, valves, and related parts.

Disconnect battery ground strap.

Drain coolant from engine before removing head.

On diesel engines, remove injection nozzles from head (see group 25). Nozzle tips extend below face of cylinder head and may be accidentally damaged.

Note location of all parts during removal for reassembly.

NOTE: Do not rotate crankshaft with cylinder head removed unless all cylinder liners are secured with cap screws and washers.

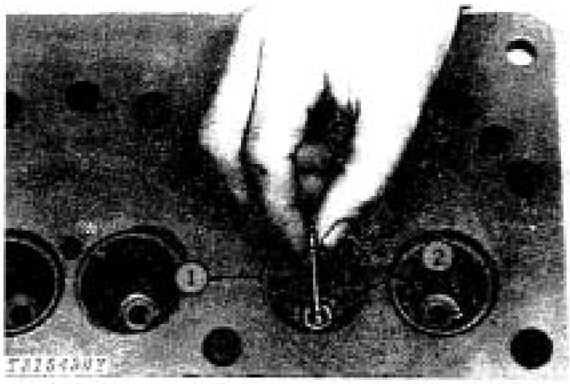
REPAIR

Cylinder Head

Check to determine if cylinder head is flat and smooth. If it is necessary to resurface the bottom deck of the head, remove no more than absolutely necessary (not to exceed 0.030 inch [0.76 mm]).

On diesel engines check distance from deck of the cylinder head to valves when seated. The distance for the intake valves must be 0.0037 ± 0.007 inch (0.94 ± 0.18 mm). The distance for exhaust valves must be 0.0057 ± 0.007 inch (1.45 ± 0.18 mm).

Valve Guides



1—Telescope Gauge 2—Valve Guide

Fig. 2-Checking Valve Guides

Check valve guides for wear (Fig. 2). Use a D20002WI Knurling Tool to knurl worn valve guides. (Use the knurling tool exactly as directed by the manufacturer.)

The I.D. of a guide in a new cylinder head is 0.3745 to 0.3755 inch (9.512 to 9.538 mm). Wear of an additional 0.0010 inch (0.025 mm) is acceptable. Compare valve stem O.D. and valve guide I.D. to determine clearance. Clearance between the two is 0.0020 to 0.0040 inch (0.051 to 0.102 mm). Clearance up to 0.0060 inch (0.154 mm) is acceptable.

Oversize valves, available in 0.003, 0.015 and 0.030 inch (0.07, 0.38 and 0.76 mm) sizes, can be used to correct clearance problems.

Valve Seats

Check valve seats for cracks or pits.

Check concentricity of valve seat with a dial indicator (Fig. 3). Total run-out should not exceed 0.002 inch (0.05 mm).

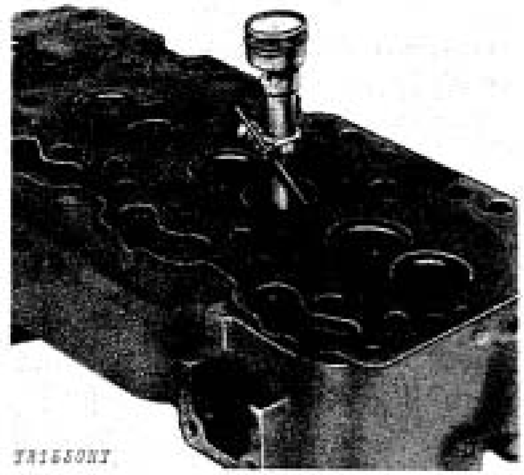


Fig. 3-Checking Valve Seat Concentricity For 0.002 inch (0.05 mm) Maximum Runout

Reface seats according to need and as directed by refacing tool manufacturer. Valve seat specifications are as follows:

Angle of valve seat	45°
Width of valve seat	
Gasoline	0.0625 to 0.0781 in. (1.588 to 1.984 mm)
Diesel	0.0781 to 0.0937 in. (1.984 to 2.380 mm)

Valves

Check valve stem and face for wear or damage. O.D. of a new valve stem is 0.3715 to 0.3725 (9.436 to 9.462 mm). Valve face angle is 44.5° on gasoline valves and 44.5° on diesel valves.

If end of valve stem on gasoline engine is excessively pitted or worn by rocker arm, grind down end of valve until squared. On diesel engines, replace valve stem caps if worn or damaged.

FOS

For information on valve refacing see "Basic Engines" of FOS Manual 30—ENGINES.

Inspecting Valve Springs

Inspect valve springs for alignment wear and damage. Place springs on a flat surface to see that they are square and parallel. Do not use springs that are cocked, crooked, or contain broken or rusty coils.

Check valve spring length on a spring tester. Free length of each spring may differ, but the compressed length for each spring must be the same. Spring specifications are as follows:

New Spring	Measurement
Compressed at 54-62 lbs (24.5 to 28.1 kg)	
Valves closed	1.81 in. (46.0 mm)
Compressed at 133-153 lbs (60.3 to 69.9 kg)	
Valves open	1.36 in. (34.5 mm)

Valve Rotators (Gasoline)

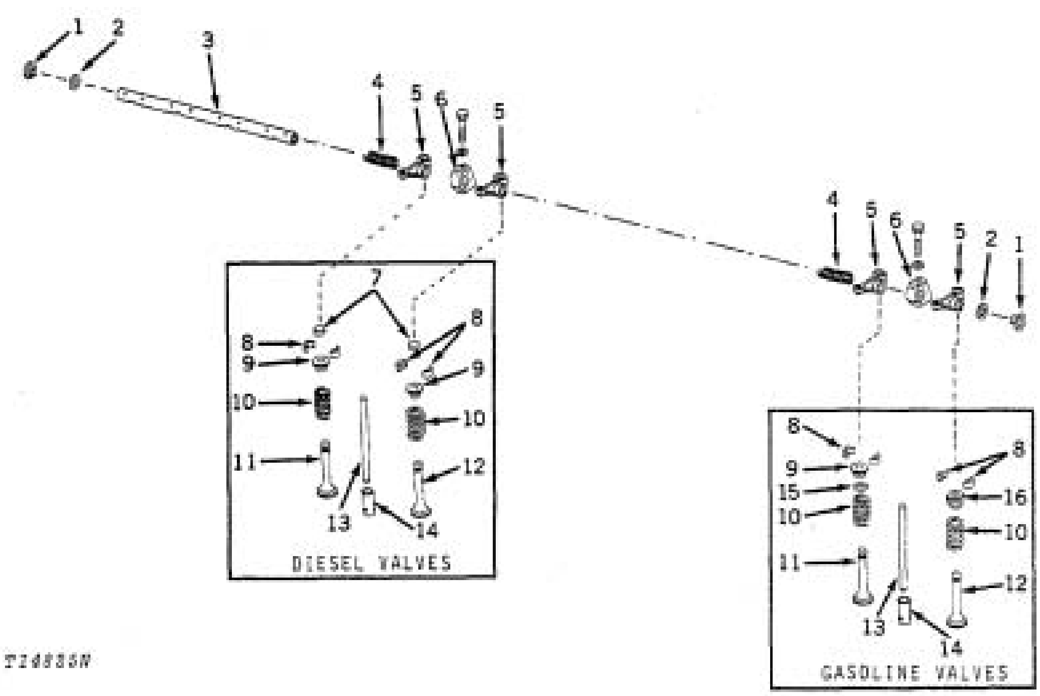
On gasoline engines, inspect valve rotators. If rotator will not turn freely in one direction, replace with a new part.

Inspecting Rocker Arm Assembly

Make sure that rocker arm oil holes are not plugged.

Check rocker arm and rocker arm shaft for wear. Rocker arm shaft O.D. is 0.7859 to 0.7889 inch (19.961 to 20.038 mm). Shaft may be 0.7849 inch (19.936 mm) and still be acceptable. I.D. of rocker arm bore is 0.7900 to 0.7920 inch (20.066 to 20.117 mm). Bore can be worn an additional 0.0020 inch (0.0508 mm).

If ends of arms are worn, replace or resurface them.



1—Plug (2 used)
2—Washer (2 used)
3—Rocker Arm Shaft
4—Spring (2 used)
5—Rocker Arm with Adjusting Screw (6 used)
6—Bracket (3 used)
7—Valve Stem Caps (Diesel) (6 used)
8—Keepers (12 used)
9—Valve Spring Cap (6 used Diesel) (3 used Gasoline)
10—Spring (6 used)
11—Intake Valve (3 used)
12—Exhaust Valve (3 used)
13—Push Rod (6 used)
14—Cam Follower (6 used)
15—Intake Valve O-Ring (Gasoline) (3 used)
16—Exhaust Valve Spring Cap Rotator (Gasoline) (3 used)

Fig. 4-Rocker Arm Assembly

Thoroughly clean holes in rocker arm mounting brackets. This is especially important for the rear bracket, because oil is fed to the rocker arm shaft through this hole.

On gasoline engines, replace the intake valve stem O-ring.

If a failed valve has been replaced, carefully inspect the rocker arm and push rod for excessive wear or damage and replace as necessary.

ASSEMBLY

Rocker Arm Assembly

Assemble parts to rocker arm shaft in sequence that they were removed (Fig. 4).

Oil hole in rocker arm shaft-to-shaft support must face downward when assembly is installed on cylinder.

Valve Assembly

Apply John Deere Valve Stem Lubricant AR44402 or equivalent to valve stems and install valves in valve guides, working them back and forth to make sure they slip through the guides easily and seat properly.

On gasoline engines, place oil deflectors (O-rings) on lower groove of intake valve stems and place rotators on exhaust valves.

Note also the following:

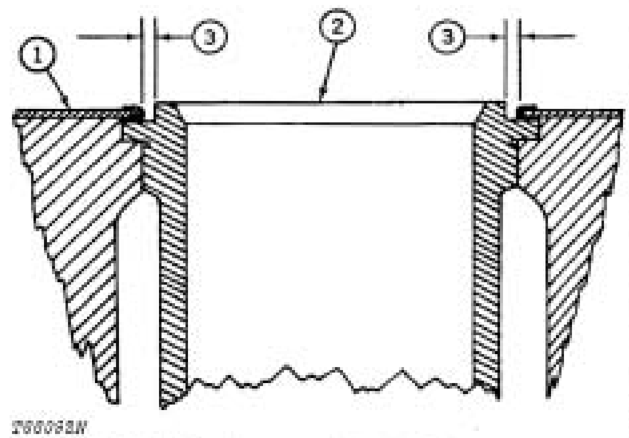
1. Use new valve keepers.

2. After assembly, "pop" each spring and valve assembly three or four times by tapping the end of each valve stem with a soft mallet.

INSTALLATION

Install cylinder head gasket dry.

Remove liquids and dirt from all tapped holes. Clean threads on cylinder head cap screws.



1—Cylinder Head Gasket
2—Cylinder Liner
3—Equal Distance Within 0.040 In. (1.02 mm)

Fig. 5-Cylinder Head Gasket

Position cylinder head gasket (1, Fig. 5) over dowels on cylinder block. Check distance between cylinder head gasket (1) and cylinder liner (2). Distance should be equal within 0.040 in. (1.02 mm) around each cylinder liner. If distance is not equal, make dowel holes in cylinder head gasket larger.

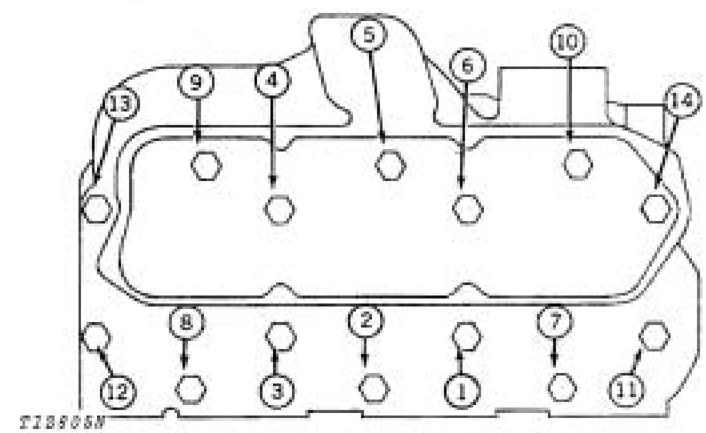


Fig. 6-Proper Sequence for Tightening Cylinder Head Cap Screws

Use specified flat washers under all cap screws. Dip cap screws in oil prior to installation. Start cylinder head to cylinder block cap screws by hand and tighten evenly to 95 lb-ft (13.1 kg-m) following sequence in Fig. 6.

Install push rods in location from which they were removed.

On diesel engines, position valve stem caps over ends of valve stems. Make certain the caps rotate freely on the stems.

Install rocker arm and shaft assembly on cylinder head. Tighten cap screws to 35 lb-ft (4.8 kg-m).

Adjusting Valve Tappet Clearance

The engine may be either hot or cold during valve adjustment.

Position No. 1 cylinder on TDC. Timing cover screw will enter its hole in flywheel (Fig. 7).

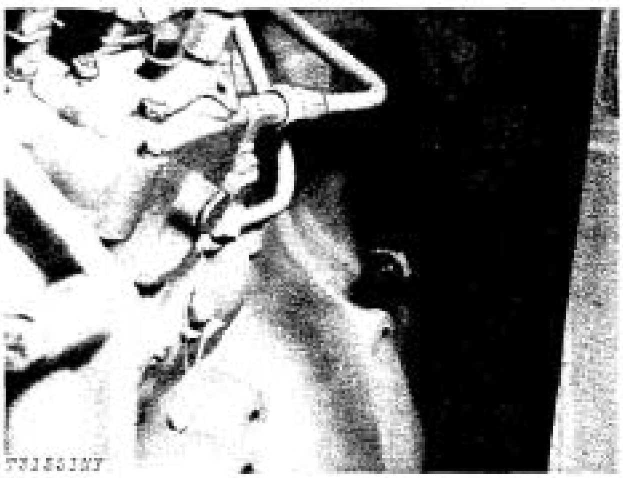


Fig. 7-Setting No. 1 Cylinder at Top Dead Center

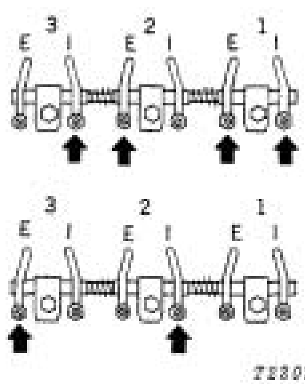


Fig. 8-Adjusting Valve Tappett Clearance

Adjust valve clearance on No. 1 and No. 2 exhaust valves to 0.018 inch (0.4572 mm) for diesel and 0.022 inch (0.5588 mm) for gasoline and on No. 1 and 3 intake valves to clearance of 0.014 inch (0.3556 mm) for both gasoline and diesel. Using a feeler gauge to measure clearance, turn valve adjusting screw up or down until clearance is correct (Fig. 8).

Remove timing screw from flywheel. Rotate engine flywheel 360 degrees and reinsert timing screw into hole on flywheel rim.

Adjust valve clearance on No. 3 exhaust and No. 2 intake valves to clearances specified.

Remove timing screw from flywheel and reinstall timing cover.

Retighten cylinder head cap screws and recheck valve clearances after thirty minutes run-in with engine at 1900 to 2200 rpm with 3/4 to full load. See "Engine Break-In", Section 20, Group 40.

NOTE: If liners, pistons or rings were replaced follow complete "Engine Break-In" in Section 20, Group 40.

CAMSHAFT

REMOVAL

To service camshaft and related parts, engine normally need not be removed from unit. If engine has to be removed, see Group 5 of this section.

Disconnect battery ground cables.

Remove rocker arm and timing gear covers. Remove rocker arm assembly and push rods.

Remove distributor and fuel transfer pump.

Check camshaft end play (Fig. 9). End play is governed by the thrust plate thickness. End play is 0.0025 to 0.0085 inch (0.064 to 0.216 mm). End play up to 0.0150 inch (0.381 mm) is acceptable.

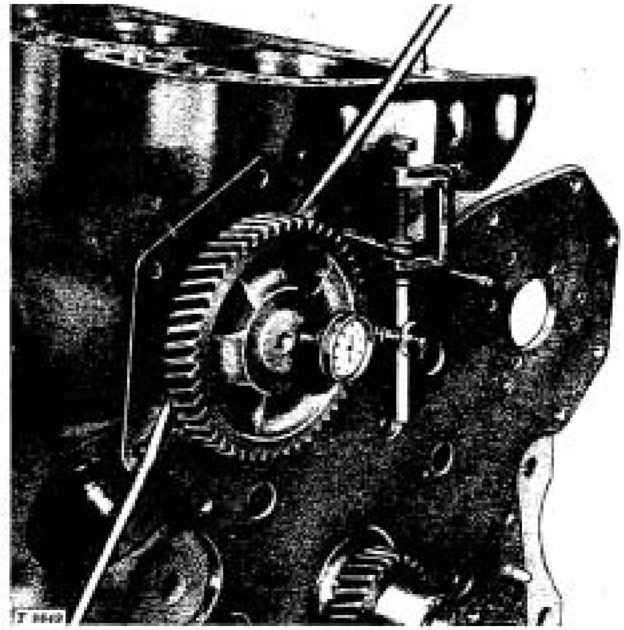
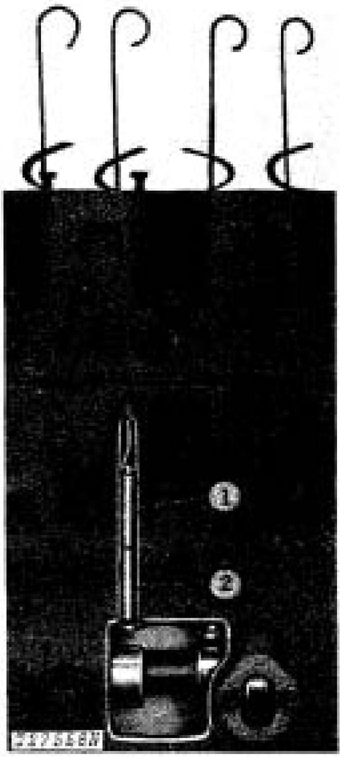


Fig. 9-Checking Camshaft End Play

Remove push rods. Use D-15001NU Magnetic Holding Tool (Fig. 10) to hold cam followers away from camshaft if the cylinder head has not been removed, or remove followers if the head has been removed. If followers are removed, mark them for identification on reassembly.



1—Follower Holding Tool **2—Cam Follower**

Fig. 10-Magnetic Cam Follower Holding Tools

Remove top idler gear from engine front plate. This will allow camshaft to rotate when lining up camshaft attaching cap screws.

REPAIR

Inspect camshaft journals and bores in block for wear or damage. Excessive wear may indicate excessive end play. O.D. of journal is 2.1997 to 2.2007 inch (55.872 to 55.898 mm). I.D. of the bore is 2.2042 to 2.2052 inch (55.987 to 56.012 mm). Maximum allowable clearance is 0.0035 to 0.0055 inch (0.089 to 0.140 mm).

New thrust plate thickness is 0.1560 to 0.1580 inch (3.962 to 4.013 mm). Maximum wear of 0.0050 inch (0.127 mm) is allowable.

If necessary, replace camshaft drive gear by pressing gear from shaft. Support camshaft under first journal. With timing mark of new gear facing away from camshaft, align gear and camshaft keyways, install Woodruff key, and press gear on until tight against cam shoulder.

If necessary, remove tachometer drive shaft by threading shaft end, placing hex. nut on shaft and pulling from camshaft.

INSTALLATION

Install the camshaft, noting the following:

1. Coat entire camshaft with a light film of oil.

2. When installing camshaft, do not permit cam lobes to drag on camshaft bores.

3. Turn the camshaft gear until the cap screws and locks which secure the thrust plate can be installed and tightened to 35 lb-ft (4.8 kg-m).

4. Recheck camshaft end play after all new or repaired parts have been assembled.

5. Before installing idler gear, set flywheel at "TDC" with No. 1 (front) piston on the compression stroke and align the timing mark on the camshaft drive gear with the center of the crankshaft, using timing tool JD254.

6. With timing marks aligned, install top idler gear and secure to front plate with flat washers and cap screw. Tighten cap screw to 65 lb-ft (9 kg-m).

Install all parts removed.

CYLINDER BLOCK, LINERS, PISTONS, AND RODS

REMOVAL

Remove the pistons and connecting rods noting the following:

1. Engine normally need not be removed from unit to service pistons, connecting rods, and cylinder liners. If engine has to be removed, See Group 5 of this section.
2. Do not rotate crankshaft with cylinder head removed unless all cylinder liners are bolted down. Bolt down cylinder liners before removing pistons.
3. Keep rod bearing inserts with their respective rods and caps to assure correct reassembly.
4. Each connecting rod and piston must be reinstalled in the cylinder bore from which it was removed. Observe the word "FRONT" stamped on the head of all pistons and in the rib of the diesel connecting rods. These must face toward the fan end of the engine at the time of reassembly. *Observe the "pip" marks on both the connecting rod and cap of a gasoline engine. These "pip" marks must both face towards the camshaft side of the engine at the time of assembly.*

IMPORTANT: Installing or removing connecting rod and main bearing cap screws using pneumatic wrenches may cause thread damage.

REPAIR

FOS

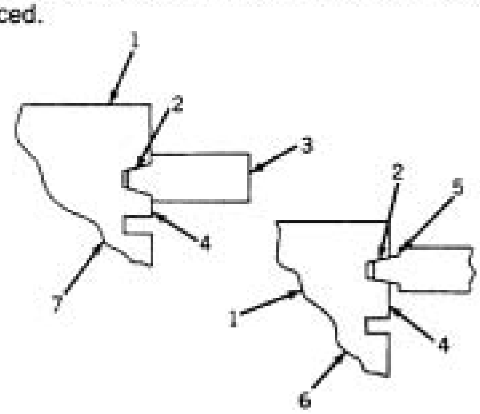
Inspect all parts and compare with "Specifications". Refer to "Basic Engine" in FOS Manual - ENGINES - for additional repair information.

Use a strong household detergent to remove all dirt and carbon from pistons. Clean carbon from piston ring grooves. Wash all parts thoroughly in cleaning solvent.

Inspect and measure piston pin, pin bore in piston, and connecting rod bushing for wear or damage. Excessive wear can cause scored pistons or broken connecting rods. Specifications are as follows:

Item	New Part	Wear Tolerance
O.D. of Pin	1.3748 to 1.3752 in. (34.920 to 34.930 mm)	0.005 in. (0.0127 mm)
I.D. of Bore	1.3753 to 1.3757 in. (34.9362 to 34.9428 mm)	0.0010 in. (0.0254 mm)
I.D. of Bushing	1.376 to 1.377 in. (34.950 to 34.976 mm)	0.0020 in. (0.0508 mm)

Use keystone ring groove wear gauge (JDE-62) as shown in Fig. 11 to measure wear to the top piston ring groove. If gauge shoulder touches ring land, the top groove is excessively worn and the piston should be replaced.



T27664

1—Piston
2—Keystone Ring Groove
3—Wear Gauge
4—Ring Land
5—Gauge Shoulder
6—Good Ring Groove
7—Worn Ring Groove

Fig. 11-Using Ring Groove Wear Gauge

Check the other two grooves for wear by inserting a new ring in the proper groove at several points around the piston. Measure clearance with a feeler gauge. If the clearance exceeds 0.008 inch (0.20 mm), replace the piston.

Check clearance between piston and cylinder liner bore to determine if replacement is necessary. Measure clearance with a feeler gauge at the bottom of piston skirt 90° to pin bore. To establish taper and out-of-round, check liner 1 inch (25.4 mm) from bottom and 1 inch (25.4 mm) from top, lengthwise and crosswise. Wear limits are as follows:

Specifications	Measurement
Liner Taper (max.)	0.0020 in. (0.051 mm)
Liner Out-of-Round (max.)	0.0020 in. (0.051 mm)
Clearance Between Liner and Piston at Bottom of Skirt (max.)	0.008 in. (0.203 mm)

Piston rings should never be reinstalled on a piston once they have been removed. Throw away old rings and replace with new ones.

Clean and inspect rods, caps, bearings, and piston pin bushings for wear or damage.

Check rod bearings for excessive wear. Use "Plastigage" or equivalent as directed by the manufacturer, if rods are connected to the crankshaft.

NOTE: The use of "Plastigage" or equivalent will determine clearance between bearing and crankshaft journal, but will not determine which surface is worn or the condition of either bearing or journal surface.

If rod is out of engine, assemble and measure the I.D. of the rod bearing, and the O.D. several places on the crankshaft rod journal. Specifications are as follows:

I.D. of Bearing	O.D. of Journal
2.7502 to 2.7522 in. (69.855 to 69.901 mm)	2.7480 to 2.7490 in. (69.799 to 69.825 mm)

Bearing Bore I.D.
2.9000 to 2.9010 in.
(73.660 to 73.685 mm)

Oil clearance should be 0.0012 to 0.0040 inch (0.030 to 0.102 mm) between rod bearings and crankshaft journals. Maximum bearing clearance is 0.006 in. (0.15 mm). Replace bearings as necessary. Undersize bearing inserts are available in 0.002, 0.010, 0.020, and 0.030 inch (0.05, 0.25, 0.51 and 0.76 mm) sizes.

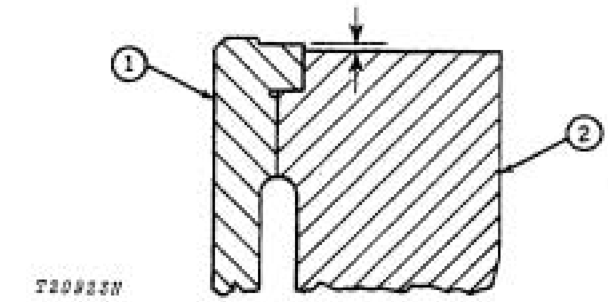
Piston pin bushing must be reamed after it is pressed into position to provide a "thumb press fit" for pin.

Clean block thoroughly with cleaning solvent or by pressure steam cleaning.

Check oil pressure regulating valve bushing in front end of block for wear or damage. If necessary, replace as directed in Group 15 of this Section.

If dipstick nipple has been removed, coat threads of nipple with joint sealing compound and install in cylinder block. Measure from block rail vertically to center of nipple end. Measurement must be 6 inches (152.4 mm) (-208266) 8 inches (203.2 mm) (208267-).

If filter base nipple is damaged remove it and press in a new nipple flush with face of bore in block. Position nipple so that threaded boss is away from side of block as far as possible.



1—Liner 2—Block

Fig. 12-Location of Liner in Cylinder Block

When installing new cylinder liners in block, use a depth gauge to check the height of the flange on the liner in relation to the cylinder block (Fig. 12). The top of the flange should be 0.001 to 0.004 inch (0.03 to 0.10 mm) above the cylinder block with packings removed from the bottom of the liner. Check this several places around the liner to make sure the liner is seated squarely in the bore of the cylinder block.

IMPORTANT: Be sure to pull cylinder liner and reinstall all packings before final assembly.

Deglazing Cylinder Liners

Use D17003BR Cylinder Brush to deglaze the cylinder liners, but not to rebore. When the liner taper exceeds 0.002 inch (0.0508 mm) maximum or liner out-of-round exceeds 0.002 inch (0.0508 mm), the liner should be replaced.

Use a 180-grit honing stone and light pressure to produce the desired 15 to 35 micro-inch R.M.S. cylinder wall finish (Fig. 13).

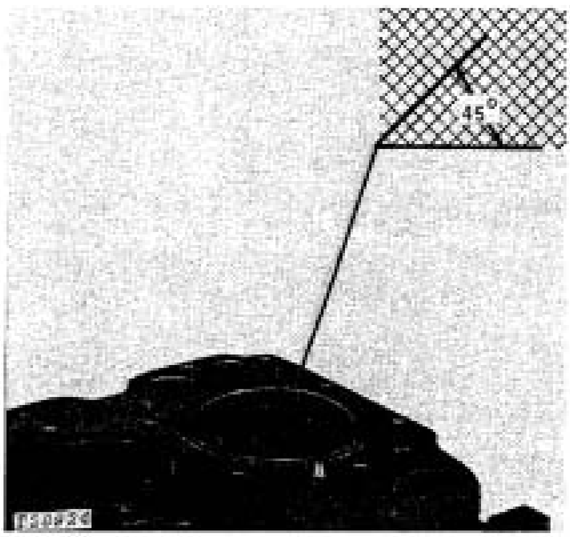


Fig. 13-Deglazing Cylinder Liner

Immediately after deglazing, clean liner bores with hot water, soap and scrub brush. Rinse cylinder liner bores with clean water until rinse water is clear. Dry liners with clean towels. Wipe bores with clean engine oil.

IMPORTANT: Solvents will not remove honing residue.

ASSEMBLY

Assembling Connecting Rod and Piston

Assemble pistons and connecting rods making sure that identification marks on piston and rod are in the same relative position as they were in at time of disassembly.

Each connecting rod and piston must be reinstalled in the cylinder liner from which it was removed.

Observe the word "FRONT" stamped on the head of all pistons and in the rib of the connecting rods. These must face toward the fan end of engine.

Coat piston pin with a light film of oil and insert into piston pin bore through connecting rod bushings and on into opposite pin bore. A properly fitted piston pin can be pressed into position with the thumb. Install new piston pin snap rings and check that rings are in grooves of piston pin bore.

Installing Piston Rings on Piston

Coat the outside of the pistons and rings with a light film of oil. Using a JDE-135 Universal Piston Ring Expander or JDE-45 Limiting Piston Ring Expander, install rings in their respective grooves.

IMPORTANT: Use of incorrect size ring expander will cause damage to rings.

1. Install the expander in the oil ring groove. Install the oil ring with dots (or "Top") facing up towards the top of the piston and position oil ring gap opposite expander (Fig. 14).

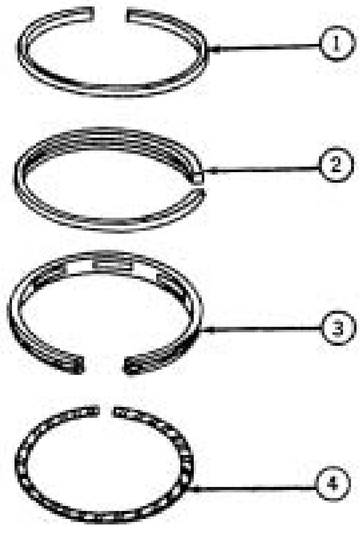
2. Install second compression ring (Fig. 14) with dots (or "Top") facing up towards the top of the piston.

3. Install the first compression ring with dots (or "Top") facing up towards the top of the piston.

4. Be sure rings move freely in their grooves.

NOTE: If rings are not marked, install with either side up.

Gasoline and diesel engines use same ring sets for service replacement.



1—1st Comp. Ring
2—2nd Comp. Ring
3—Oil Ring
4—Oil Ring Expander

Fig. 14-Ring Installation

INSTALLATION

Installing Cylinder Liners

Before installing liners it is important to make sure the counterbore, under the liner flange at top is completely free from dirt or nicks.

Carefully install a new, dry black, rectangular packing over the bottom end of the cylinder liner. Slide packing firmly against the shoulder of the liner, making sure the packing is not twisted or crimped.

Dip cylinder bore O-ring into John Deere Soap Lubricant (AR54749) or equivalent and install red O-ring in upper groove and black O-ring in lower groove in cylinder block. Check that O-rings do not protrude outside the grooves and are not twisted.

Coat the liner packing, seating area of the liners, and new cylinder bore O-rings with John Deere Soap Lubricant (AR54749) or equivalent.

NOTE: If you suspect that a packing may have sheared or displaced during lowering into position, the liner and packing assembly should be removed and examined.

Work liners gently in place as far as possible by hand. Finish seating liners by placing a wood block over upper end and tapping block lightly with hammer.

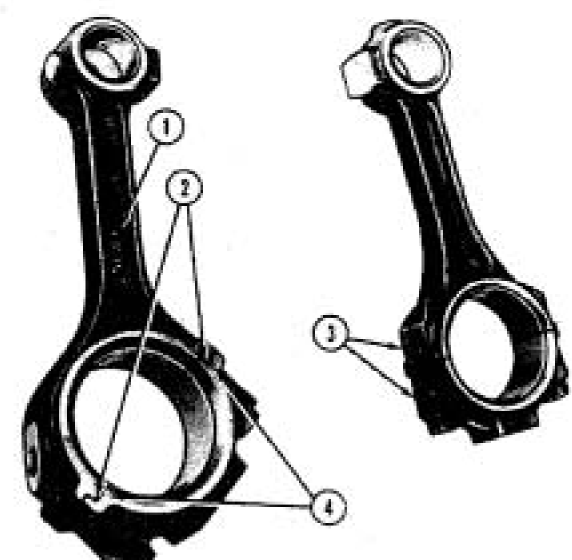
Cylinder liner will protrude over the top of the cylinder block more than normal due to the uncompressed packing.

Clean cylinder liner bores with waterless hand cleaner after installation in block. Wipe dry with clean towels. Coat cylinder liner bores with engine oil just before installing pistons.

Installing Pistons

Use short cap screws and large flat washers to retain liners in position while pistons are installed.

Install top piston ring with gap above one end of piston pin and stagger ring gaps before installing them in cylinder liners.



1—"FRONT"
2—Tangs
3—"PIP"
4—Slots

Fig. 15-Connecting Rods

Be sure the word "FRONT" stamped on the head of the pistons faces toward the fan end of the engine before installing them in liners. On diesel connecting rods, be sure the word "FRONT" faces toward the fan end of engine. On gasoline connecting rods, be sure the "pip" mark faces toward the fan end of engine.

Fig. 16-Installing Pistons, Using JD271 Compressor

Use special compressor tool JD-271 to install pistons (Fig. 16).

Apply light-weight oil to the bearing inserts and crankshaft rod journals.

IMPORTANT: Installing or removing connecting rod and main bearing cap screws using pneumatic wrenches may cause thread damage.

Dip connecting rod cap screws in oil and tighten to 65 lb-ft (9 kg-m) for diesel and 45 lb-ft (6.2 kg-m) for gasoline.

Installing Oil Pan

Apply Permatex No. 3 Sealing Compound or equivalent to oil pan gasket and cylinder block pan surface.

Tighten oil pan-to-cylinder block and timing gear cover cap screws with 35 lb-ft (4.84 kg-m).

Engine Break-In

Refer to specifications and perform the break-in steps to insure proper run-in of new parts during the first hours of a rebuilt engine. (See Group 40 of this section).

CRANKSHAFT, MAIN BEARINGS, AND FLYWHEEL

REMOVAL

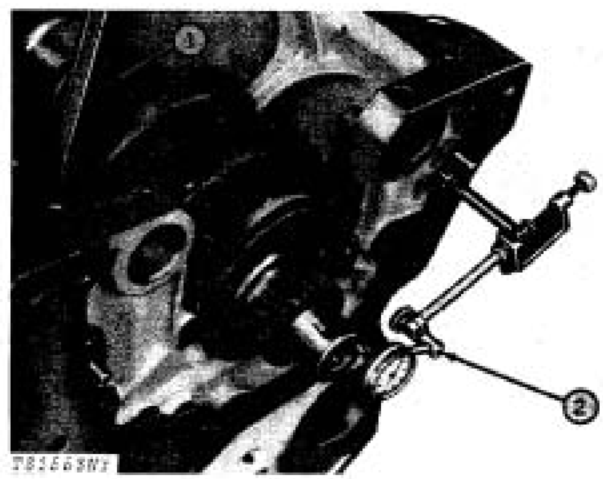
To service crankshaft, main bearings and flywheel, it is necessary to remove engine from the unit (see Group 5 of this section).

Remove oil pan, timing gear cover, starting motor, flywheel, and pistons.

REPAIR

Checking Crankshaft End Play

Measure crankshaft end play and determine if it is within 0.0020 to 0.0080 inch (0.0508 to 0.2032 mm). End play exceeding this specification indicates a worn thrust bearing. However, a maximum end play of 0.0150 inch (0.381 mm) is acceptable.



1—Pry Bar **2—Dial Indicator**

Fig. 17-Checking Crankshaft End Play

Crankshaft and Flywheel

Examine clutch friction surface on flywheel for heat check or roughness.

CAUTION: Oil fumes or oil can ignite above 380°F (193.3°C). Use a thermometer and do not exceed 360°F (182.2°C). Do not allow a flame or heating element to be in direct contact with the oil. Heat the oil in a well-ventilated area. Plan a safe handling procedure to avoid burns.

Examine flywheel ring gear for wear or damage. If new gear is needed, heat gear evenly (to not more than 360°F [182.2°C]) and install hot, with chamfered edge of teeth toward front of flywheel.

Check clutch pilot bearing for wear or tight spots. To install new pilot bearing, pack with high temperature grease (AT30408) and drive in (shielded side out) to bottom of bore. Reinstall snap ring if used.

Check crankshaft gear for wear or damage. To replace, remove gear with knife edge puller. To install, heat gear to approximately 360°F (182.2°C) (do not overheat), place Woodruff key in keyway and support crankshaft under first throw while pressing on gear.

Inspect crankshaft journals. Dress journals with fine emery cloth as needed.

Check thrust surfaces on thrust bearing journals to make sure they will not damage the thrust bearing flanges.

Check each journal with a micrometer at several points to determine if journal is out-of-round by more than 0.0030 inch (0.0762 mm) or if tapered more than 0.0010 inch (0.0254 mm) per inch (25.4 mm) of journal length.

Excessively eccentric or tapered journals will give an uneven clearance between journal and bearing insert. Regrind such journals and use the proper undersize bearing inserts.

Note O.D. of journals for later use to determine clearance between journal and bearing insert.

Main Bearings

Examine all main bearings for wear, scoring, or damage.

Check main bearing caps for identifying numbers. If there are no numbers, stamp corresponding numbers in one oil pan rail and in main bearing cap. Stamp the number in each main bearing cap off center to the same side as the number in the oil pan rail. This will assure correct indexing of main bearing caps during installation.

Check thrust bearing thrust surfaces to confirm that thrust bearing wear was the cause for excessive crankshaft end play.

On diesel engines, remove piston cooling orifices from main bearing webs and check for damage or clogging. Repair or replace as necessary. Install orifices and tighten with 85 to 110 lb-in (0.98 to 1.27 kg-m).

Main Bearing Clearance

If the crankshaft is out of the engine block, check main bearing clearance by measuring I.D. of the bearing halves assembled in the block. Compare with the crankshaft journal O.D. measurements to determine clearance. Specified new part diameters and clearance are as follows:

O.D. of main bearing journal	3.1230 to 3.1240 in. (79.3242 to 79.3496 mm)
I.D. of main bearing (assembled)	3.1256 to 3.1276 in. (79.390 to 79.441 mm)
Bearing to journal clearance	0.0016 to 0.0046 in. (0.041 to 0.117 mm)
Main bearing bore I.D.	3.3250 to 3.3260 in. (84.455 to 84.480 mm)

A maximum clearance of 0.0060 inch (0.152 mm) is acceptable.

Clearance can be determined with the use of "Plastigage" or equivalent while the main bearings are assembled on the crankshaft. Follow the instructions supplied by the manufacturer.

NOTE: If the engine is still in the tractor, use a light jack to raise the crankshaft against the upper half of the bearing. Keep all caps tight except the bearing being checked. Do not turn crankshaft.

The use of "Plastigage" or equivalent will give bearing clearance, but will not reveal whether wear is on the crankshaft journal or on the bearing.

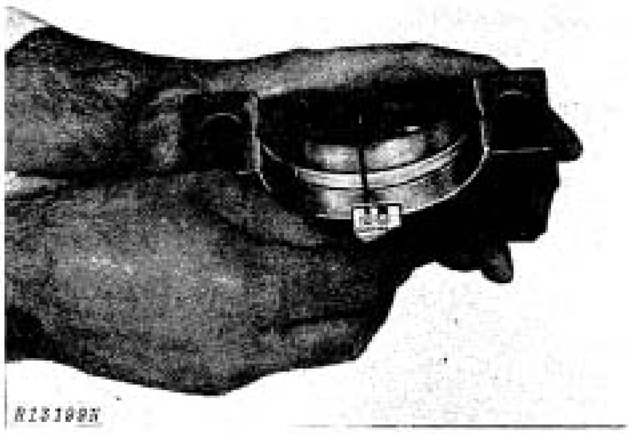
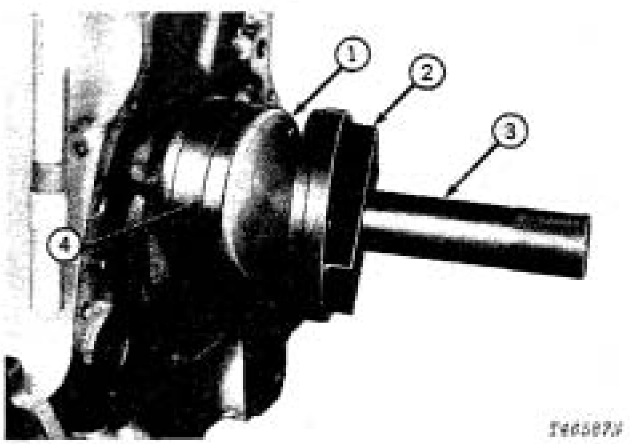


Fig. 18-Determining Main Bearing Clearance

If bearing clearance exceeds wear tolerance, replace with new undersize bearings or regrind the crankshaft. Be sure to use the proper undersize bearings, 0.002, 0.010, 0.020 and 0.030 inch (0.05, 0.25, 0.51 and 0.76 mm) undersize bearings are available.

To remove old seal wear ring from crankshaft, scribe lines across wear ring with the aid of a dull chisel until ring can be removed. **IMPORTANT: Do not scribe lines too deep in wear ring, as crankshaft wear ring surface may be damaged.**

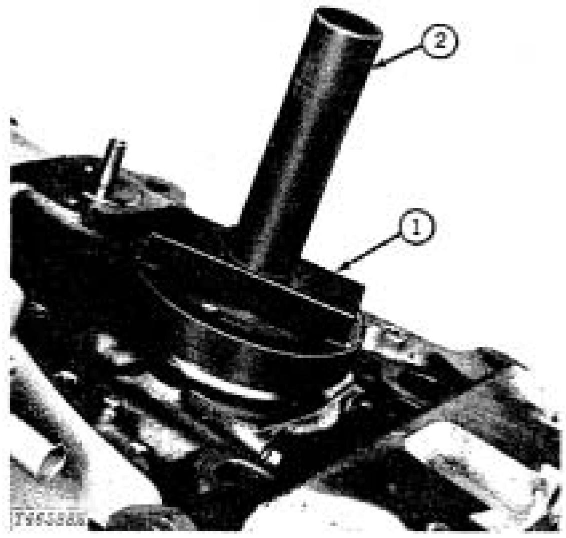


1—JD-251-2 Pilot Plate **3—27489 Handle**
2—JD-297-1 Driver **4—Wear Ring**

Fig. 19-Positioning Wear Ring

It is not necessary to use the JD-251-2 Pilot Plate or 27489 Handle to install a new wear sleeve. However, these tools help in installation (Fig. 19).

If the JD-251-2 Pilot Plate is used, it must be removed once the wear sleeve is started so the JD-297-1 Driver will bottom on the crankshaft to properly seat the wear ring.



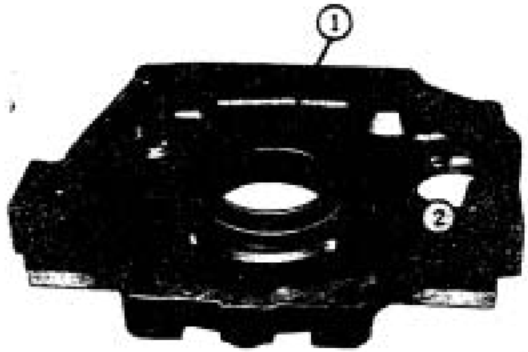
1—JD-297-1 Driver **2—27489 Handle**

Fig. 20-Installing Crankshaft Seal Wear Ring

Slide new wear ring (rounded edge of ring outward) over JD-251-2 Pilot Plate (if used) and start wear ring onto crankshaft flange by hand (avoid heavy pressure or cocking of wear ring). Place JD-297-1 Driver (1, Fig. 20) over pilot plate until it contacts wear ring. Tap driver with mallet to start wear ring. Remove pilot plate. Drive wear ring onto flange until the driver bottoms.

Do not nick or damage wear ring oil seal surface. Check crankshaft and wear ring surfaces for nicks and clean up if necessary.

Remove old oil seal from flywheel housing.

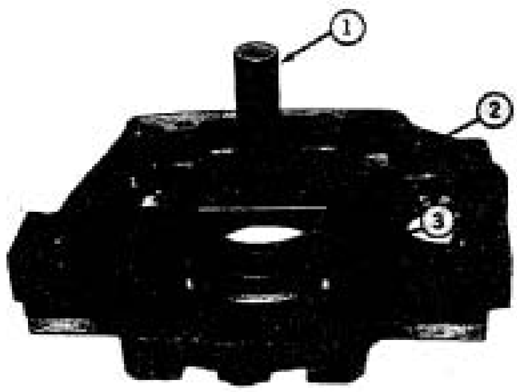


1—JD-297-2 Pilot
2—Crankshaft Rear Oil Seal

Fig. 21-Pilot and Oil Seal in Place

Place flywheel housing on a flat, even surface to install the oil seal.

Place JD-297-2 Pilot and oil seal in flywheel housing as shown in Fig. 21.



1—27489 Handle
2—JD-297-1 Driver
3—Oil Seal

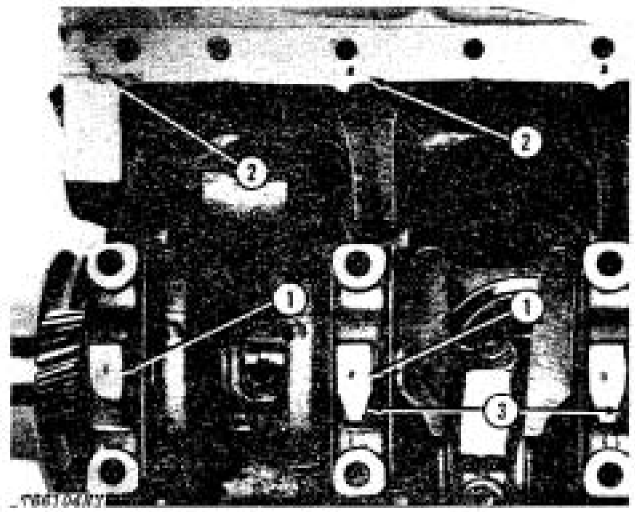
Fig. 22-Installing Crankshaft Rear Oil Seal

It is not necessary to use 27489 Handle with the JD-297-1 Driver to install the oil seal but it does help (Fig. 22).

Use a mallet to drive in the oil seal until the driver bottoms on the pilot.

Installation

Install main bearing caps with numbers corresponding to numbers in oil pan rail and to the same side as the numbers in the oil pan rail.



1—Number in Main Bearing Cap
2—Number in Oil Pan Rail
3—Arrow

Fig. 23-Main Bearing Cap Positions

If numbers were stamped in main bearing caps (1, Fig. 23) at factory, install main bearing caps with numbers corresponding to numbers in oil pan rail (2). The "arrow" (3) machined on the main bearing cap number pad must point toward the cam shaft side of the cylinder block.

Install inserts with thrust faces in rear main bearing bore. Install plain inserts in other main bearing bores. Make sure that tangs on all inserts fit the locking grooves in the bores and that the oil holes in inserts line up with oil passages in the block.

Make sure bearing caps are installed on the mains from which they were removed by referring to identification marks made at the time of removal. Dip each main bearing cap screw in oil. Loosely install cap screws in main bearing caps until finger tight.

Align upper and lower thrust flanges on rear main bearings as follows: Tap the crankshaft to the rear to line up the front flanges. Then tap the crankshaft to the front to line up the rear flanges. Tighten main bearing cap screws to 85 lb-ft (11.752 kg-m).

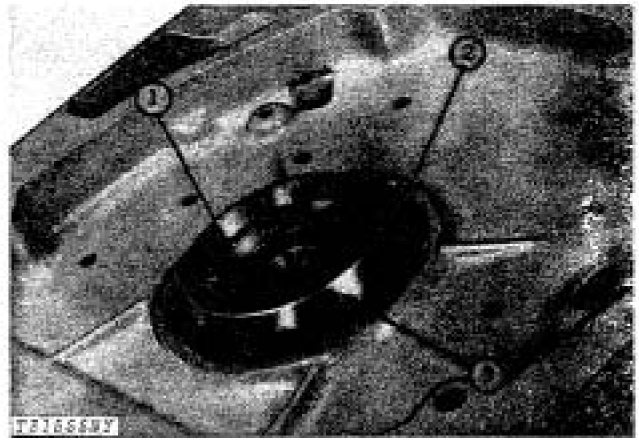
If crankshaft end play has not been checked with all repair parts installed, check it by method given on page 20-10-10. End play is 0.0020 to 0.0080 inch (0.0508 to 0.2032 mm). End play up to 0.0150 inch (0.3810 mm) is acceptable.

Position JD251-4 seal protector over rear of crankshaft and coat protector and wear ring with engine oil. Install flywheel housing on rear of engine. Be careful not to invert oil seal lip in flywheel housing. Tighten flywheel housing cap screws to 35 lb-ft (5 kg-m).

To facilitate installation of flywheel, screw two pilot studs into flywheel mounting screw holes in crankshaft.

NOTE: It is recommended that "D" grade cap screws be replaced with "F" grade cap screws and hardened washers.

Install cap screws. Tighten "D" grade cap screws to 85 lb-ft (12 kg-m). "F" grade cap screws to 120 lb-ft (18 kg-m).



1—Crankshaft
2—Wear Ring
3—JD251-4

Fig. 24-Installing Flywheel Housing

Place crankshaft oil slinger over front end of crankshaft with inside diameter of slinger against front gear on crankshaft.

Install all other parts removed.

Install engine (See Group 5 of this section).

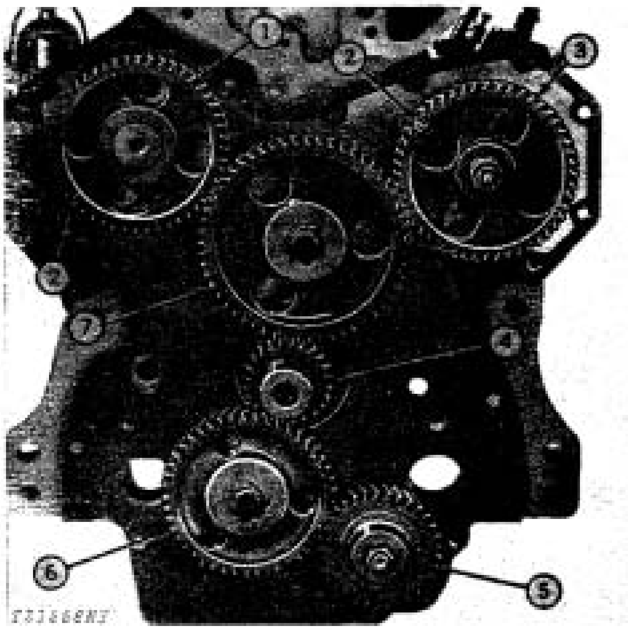
TIMING GEAR TRAIN

REMOVAL

To service gear train and related parts, with the exception of the crankshaft, engine normally need not be removed. If engine must be removed, see Group 5 of this Section.

Whenever an engine is being completely reconditioned or the crankshaft is being removed, the engine front plate with gear assemblies should be removed from the engine using the following steps:

1. Remove oil pressure regulating valve and timing gear cover.
2. Remove hex. nuts from the oil pump, drive gears and cap screws from upper and lower idler gears.
3. Remove upper and lower idler gears from engine front plate. Attach a puller to oil pump gear and pull gear from shaft. NEVER PRY GEAR FROM SHAFT.
4. Remove oil pump (Group 15).
5. On diesel engines, remove fuel injection pump and drive gear (Group 25). On gasoline engines, remove governor (Group 25).
6. Remove camshaft.



1—Camshaft Gear
2—Timing Mark
3—Injection Pump Gear (Diesel)
4—Crankshaft Gear
5—Oil Pump Gear
6—Lower Idler Gear
7—Upper Idler Gear

Fig. 25-Engine Timing Gear Train

REPAIR

For gear inspection and repair, refer to the section and group in the manual which covers the assemblies which the gears drive. The camshaft and crankshaft must be removed from the engine to replace their gears.

Checking Gear Train Backlash

Gear train noise can be an indication of excessive gear lash or damaged teeth. Check backlash before removing gears. Specified timing gear train backlash is as follows:

Gear	Backlash
Crankshaft to upper idler	0.0027 to 0.0116 in. (0.065 to 0.295 mm)
Upper idler to camshaft	0.0028 to 0.0135 in. (0.071 to 0.343 mm)
Upper idler to injection pump	0.0028 to 0.0135 in. (0.071 to 0.343 mm)
Crankshaft to lower idler	0.0027 to 0.0137 in. (0.069 to 0.348 mm)
Lower idler to oil pump	0.0016 to 0.0147 in. (0.043 to 0.373 mm)
Upper idler to governor	0.0023 to 0.0127 in. (0.058 to 0.323 mm)
Camshaft to distributor	0.0005 to 0.0075 in. (3.013 to 0.191 mm)

Replace gears as necessary.

Idler Gears

Be sure that oil hole in upper idler gear is open.

Check both idler gears for excessive end play. New part end play should be 0.0010 to 0.0070 inch (0.025 to 0.178 mm). A maximum 0.0150 inch (0.381 mm) end play is acceptable.

Measure I.D. of bushing and O.D. of shaft to determine oil clearance of 0.0015 to 0.0035 inch (0.038 to 0.089 mm). A maximum 0.0061 inch (0.1524 mm) clearance is acceptable. New bushing I.D. is 1.7520 to 1.7530 inches (44.501 to 44.526 mm). New shaft O.D. is 1.7495 to 1.7505 inches (44.437 to 44.463 mm).

If excessive wear or oil clearance is indicated, use JD-252 Bushing Driver to install new bushing flush with either side of gear.

If idler gear shaft replacement is necessary, press in new spring pins to 0.20 to 0.28 inch (5.1 to 7.1 mm) above shaft.

Front Plate and Timing Gear Cover

Never pry or press against timing gear cover with excessive force. The cover is cast aluminum alloy and might be sprung or warped.

On gasoline engines, inspect governor shaft bushing in timing gear cover for galling or excessive wear. Replace if necessary. Using tool JD-246, press in new bushing until flange on bushing contacts timing gear cover.

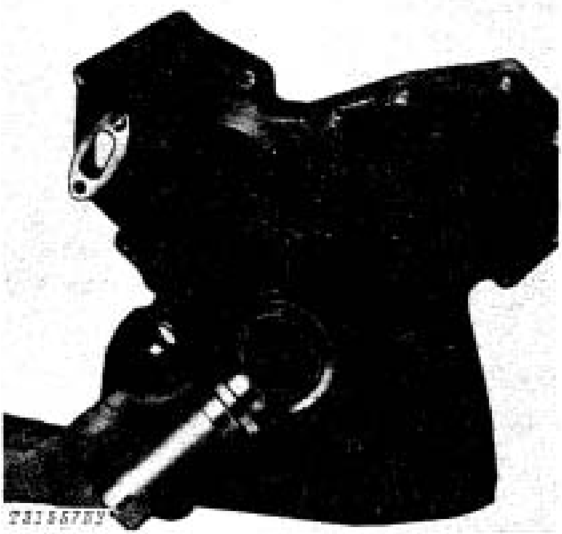


Fig. 26-Installing Oil Seal in Timing Gear Cover Using JD-250 Driver

If there is evidence of oil leakage on outside of timing gear cover, replace crankshaft front oil seal.

Coat outer surface of seal with joint sealing compound and inside surface with multi-purpose grease. Support the oil seal bore area of timing gear cover. Press in oil seal to bottom of bore with spring loaded lip facing inward using special JD-250 driver (Fig. 26).

INSTALLATION

Installing and Timing the Gear Train

The camshaft gear and injection pump gear must be timed to the crankshaft when they are installed. Install and time gear assemblies using the following steps:

1. Turn crankshaft until No. 1 piston is at top dead center (TDC) of its compression stroke. Remove timing hole cover and screw on flywheel housing. Reversing the screw, insert the smooth end into the flywheel housing bore. Rock the flywheel until the screw slides into hole in flywheel.

If engine is stripped, position crankshaft so that No. 1 (fan end) connecting rod journal is at its highest point toward the deck of the engine at this time. The keyway in the crankshaft front gear (not pulley keyway) should now point straight up toward the top of the engine.

Do not rotate crankshaft after "TDC" setting has been made.

2. Install camshaft.

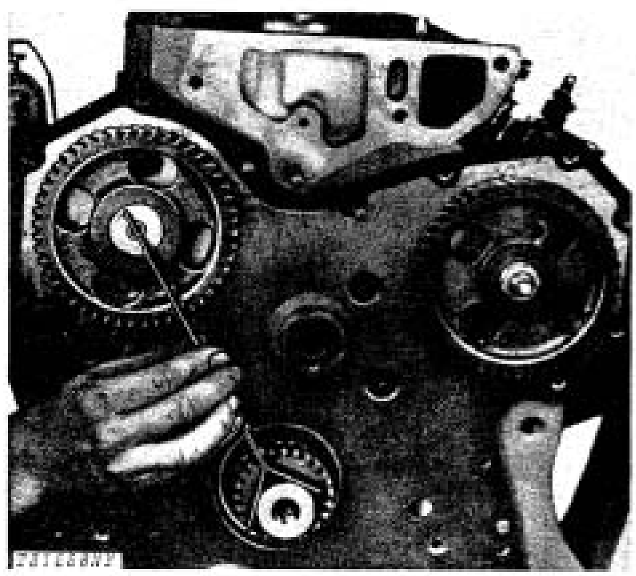


Fig. 27-Timing the Camshaft Gear with JD-254 Tool

With engine at "TDC," use special tool JD-254 to align the timing mark on the camshaft gear between centers of the crankshaft and camshaft (Fig. 27).

3. Install fuel injection pump and drive gear or governor (Group 25).

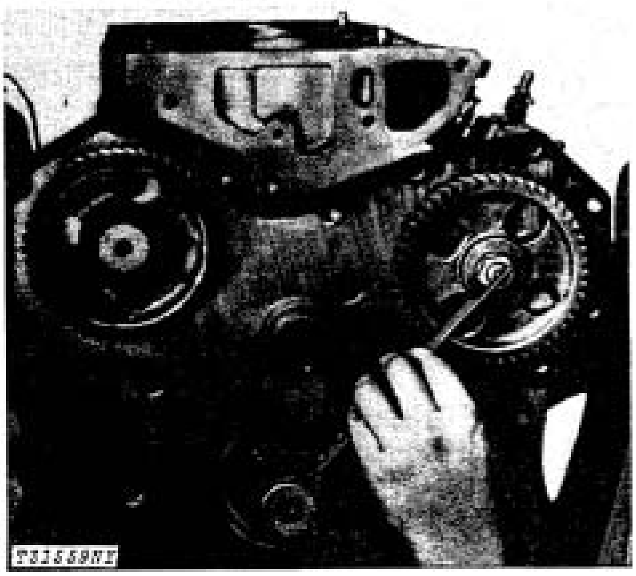


Fig. 28-Timing the Injection Pump Gear with JD-254 Tool

On diesel engines, with engine at "TDC," use special tool JD-254 to align the timing mark on the injection pump gear between centers of crankshaft and injection pump shaft (Fig. 28).

Use the timing mark on the injection pump drive gear which indicates the number of cylinders in the engine.

4. With camshaft and injection pump gear or governor installed and timed, carefully install upper idler gear into position using care not to rotate the timing gears. Be sure inner thrust washer and idler gear shaft are in place behind idler gear.

Install outer thrust washer, making sure holes in inner and outer thrust washers fit over spring pin or idler gear shaft. Install special washers and cap screw and tighten to 65 lb-ft (9 kg-m).

5. Install oil pump and drive gear (Group 15).

Tighten oil pump gear hex. nut 35 to 45 lb-ft (4.8 to 6.2 kg-m) after gears have been timed and lower idler gear installed so that gears may be restrained with a screwdriver. Then stake threads on shaft.

6. With oil pump gear installed, install lower idler gear into position, using care not to rotate any gears. Be sure inner thrust washer is in place on rear of idler gear shaft.

Install outer thrust washer, making sure holes in inner and outer thrust washers fit over spring pin in idler gear shaft. Install inner and outer special washers and cap screws and tighten to 95 lb-ft (13.1 kg-m).

After all gears are locked in place, recheck all timing marks with special tool JD-254, making sure that marks still align between the centers of the respective shafts and the center of the crankshaft with the engine at "TDC." Then remove timing screw from flywheel and install timing hole cover.

Final Installation

Apply a thin coat of high temperature grease to the inside lips of the front oil seal and install timing gear cover. Be careful not to invert lips of oil seal while installing cover.

Before installing gear cover on engine be sure that oil slinger is securely positioned over end of crankshaft with inside against gear. Also be sure oil pressure regulating valve and spring are in place under cover.

Group 15
ENGINE LUBRICATION SYSTEM

GENERAL INFORMATION

The engine lubrication system consists of the oil filter and oil pump.

The oil filter is mounted on the right side of the engine. It filters impurities out of the crankcase oil.

The engine oil pump is mounted in the oil pan. Oil enters the pump from the rear through the pump intake tube and is discharged at the oil outlet hole into an oil tube leading to the oil filter and an engine oil gallery.

A pressure regulating valve is located at the fan end of cylinder block in the oil gallery. Under normal conditions it is not necessary to adjust pressure but it can be done by adding or subtracting shims or adding a large aluminum washer behind the valve plug. When oil pressure is greater than the spring pressure, oil is bypassed to the crankcase and desired pressure is maintained.

OIL PUMP

Removal

Check engine oil pressure before removing pump (See Group 10, Section 70).

Drain oil from engine and remove oil pan.

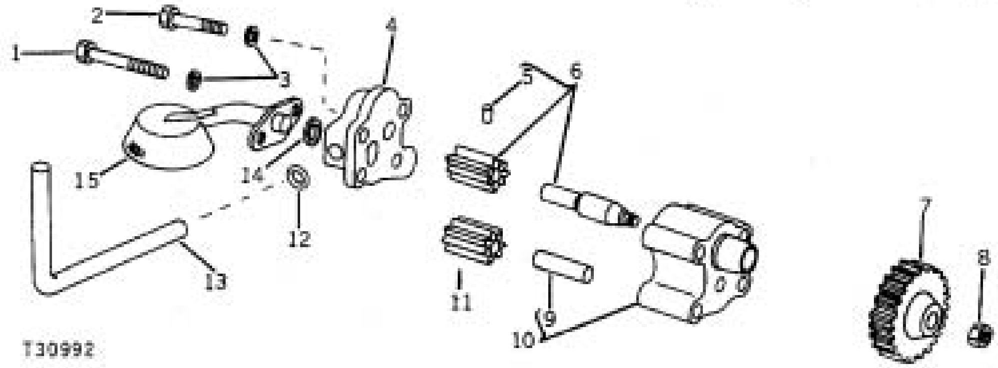
Remove cap screws holding pump to block.

Repair

Remove idler gear (11, Fig. 1) from idler shaft (19); then support housing and press out shaft.

Inspect pump housing surface which attaches to cover for rough burred or warped conditions. Replace if necessary.

Examine pump cover (4) mounting surface. A damaged cover must be replaced. The seal between cover and pump housing is dependent upon these two surfaces being perfectly flat and smooth.



1—Cap Screw (2 used)
2—Cap Screw (2 used)
3—Lock Washer (4 used)
4—Cover Assembly
5—Groove Pin
6—Drive Shaft with Gear and Pin
7—Drive Gear
8—Nut
9—Idler Shaft
10—Housing
11—Idler Gear
12—O-Ring
13—Outlet Tube
14—O-Ring
15—Oil Pump Intake

Fig. 1-Oil Pump

Examine screen on cover to be sure it is clean and the wire mesh of the screen is not damaged.

Inspect inlet and outlet tubes for clogging.

Carefully inspect pump drive shaft (6, Fig. 1) assembly for wear, especially at points of contact. Check diameter of drive shaft (0.6308 to 0.6312 inch [16.022 to 16.033 mm]) at point where it rides in bore of housing and replace if necessary. (The pump drive shaft is not available separate from the pump gear and groove pin.)

Measure width of gears (1.6203 to 1.6223 inch [41.156 to 41.206 mm]).

Install gears in housing in running position and measure radial clearance (0.0030 to 0.0060 inch [0.076 to 0.152 mm]) between gears and straightedge.

Place a straightedge across top of housing (to represent cover) and measure clearance (0.0012 to 0.0062 inch [0.031 to 0.158 mm]) between gears and straightedge.

Oil Pressure Regulating Valve

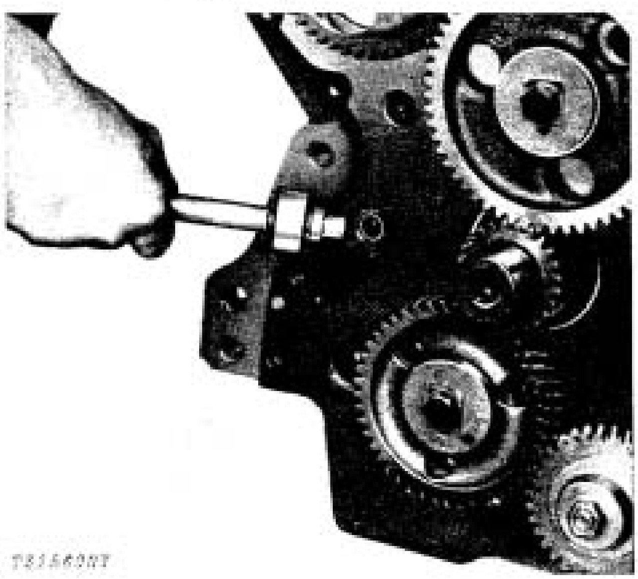


Fig. 2-Installing Pressure Regulating Valve Bushing with JD-248-A Driver

Remove oil pressure regulating plug shims (if used), spring and valve. Save any shims used for correct reassembly.

Inspect regulating valve seat in front of cylinder block for damage (especially at raised rim of bushing).

Press new bushing into block using JD248-A tool. Press in bushing until outer recessed edge of bushing is flush with bottom of counterbore in block. Do not press on raised inner rim of bushing. This rim is the regulating valve seat.

Check oil pressure regulating spring. Test length is 1.68 (42.7 mm) at 15 ± 5 lbs. (6.8 ± 2.3 kg) pressure.

Check pressure regulating valve plug threads for damage.

Assembly

Press idler shaft (9, Fig. 1) into pump housing until flush with outer surface of housing.

Place drive shaft and gear (11) in housing. Install pump idler gear on idler shaft in housing. Check to see that both gears rotate freely in housing.

IMPORTANT: Put engine oil on gears before assembling oil pump.

Install new O-ring (12) in oil outlet opening in oil pump cover.

Installation

Place pump housing with gears and drive shaft in position in engine. Install drive gear on shaft. Tighten hex. nut to 35 to 45 lb-ft (4.8 to 6.2 kg-m) and then stake nut to shaft.

Position oil pump cover and screen up against pump housing. Install pump outlet oil tube in cover. Fasten cover in place with four cap screws and lock washers. Tighten to 35 lb-ft (4.8 kg-m).

Place valve and spring in valve hole in engine timing gear cover. With an aluminum washer on valve plug and same number of shims (if used) in plug counterbore as removed, install plug in timing gear cover. This is a preliminary setting to be used until oil pressure can be checked.

Fill lubrication system with proper oil.

After installing oil pump, check engine oil pressure (see Group 10, Section 70).

ENGINE OIL FILTER

Removal

Unscrew filter element from engine and discard it. Inspect oil passages at mounting point on cylinder block for obstructions. If filter base nipple in block is damaged, refer to Group 10 of this section for replacement details.

Repair

Replace oil filter element every 200 hours of operation, or sooner if necessary.

Advise the operator to replace filter element only with a John Deere filter element supplied by his dealer.

The filter element has a special bypass valve to protect the engine in case of filter clogging.

Installation

Install new filter element. Turn element down until sealing ring just contacts mounting pad; then turn down an additional 1-1/2 turns.

Check for leaks around filter element. Retighten if necessary, but do not overtighten.

Group 20
ENGINE COOLING SYSTEM

GENERAL INFORMATION

The engine cooling system consists of the radiator, water pump and fan, and thermostat and housing.

Coolant temperature is controlled by a thermostat. A bypass line from the thermostat housing to the water pump allows fast engine warm-up and a uniform cooling temperature throughout the cylinder block. The pressure-type radiator cap is equipped with a pressure valve which permits a pressure build-up in the cooling system.

The centrifugal-type water pump attaches directly to the cylinder block and is driven by the fan belt. A bellows-type seal assembly is pressed into the pump housing between the pre-lubricated ball bearing and the impeller. If the seal becomes worn or damaged, water will escape through a drain hole near the bottom of the pump housing.

RADIATOR

Removal

Drain radiator and disconnect water inlet and outlet hoses. Remove return line from hydraulic oil reservoir.

Remove grille guard (if used).

If tractor is equipped with a reverser, also disconnect cooler return line from bottom of oil cooler and cooler inlet line from top of cooler.

Remove fan shroud from radiator and slip back over fan. Remove cap screws securing radiator to front end support mounting pads and slide radiator out left side of tractor (Fig. 1).

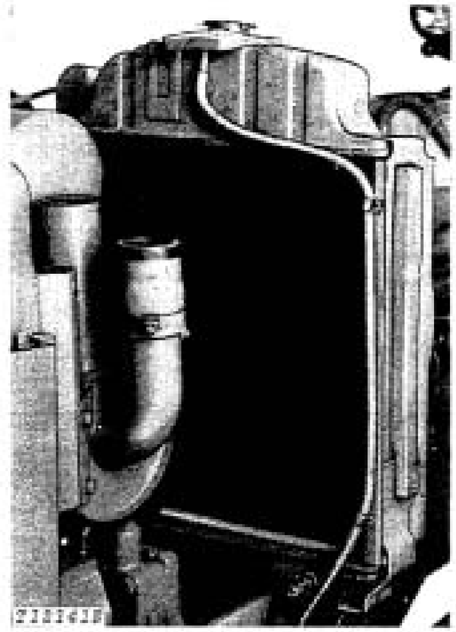


Fig. 1-Removing Radiator (Unit Without Reverser Shown)

Repair

FOS

Refer to "Cooling Systems" in FOS Manual-ENGINES for radiator inspection and repair.

Installation

To install the radiator, follow removal procedure in reverse order.

IMPORTANT: Install front support end of side grille retaining spring with open end of hook facing front of tractor.

Fill radiator with soft clean water and proper additive.

WATER PUMP

Removal

Drain coolant from radiator and engine block.

Remove radiator (see page 20-20-1).

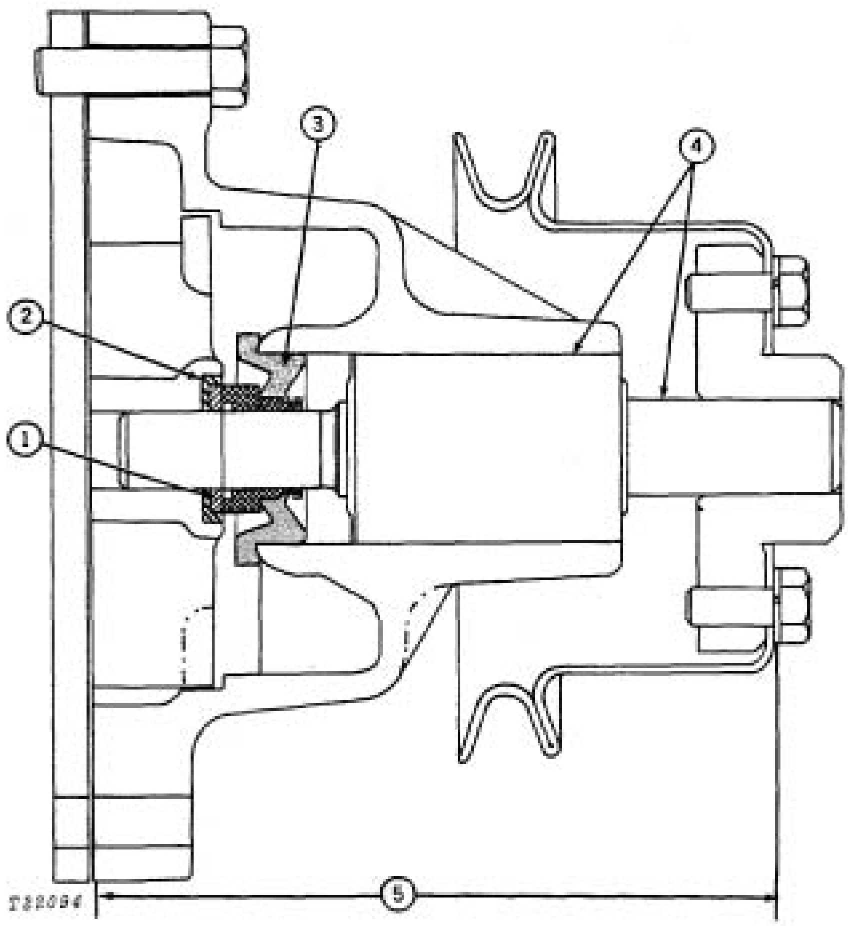
Remove fan belt. Remove cap screws attaching water pump to engine and remove water pump.

Repair

Disassembly

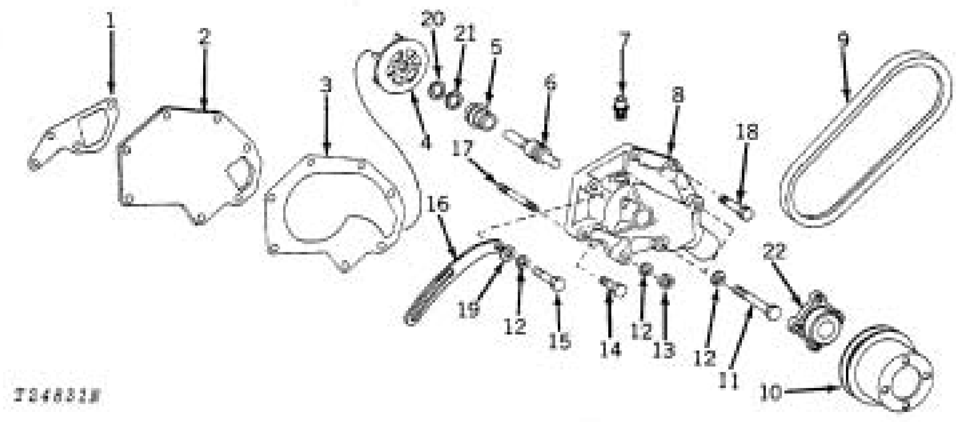
Remove the rear cover plate and gasket from the pump housing (Fig. 2).

Select a drift which is slightly smaller that the bearing shaft and, supporting fan hub, press hub from water pump.



1—Insert
2—Cup
3—Seal
4—Bearing and Shaft
5—5-1/2" [139.7 mm]

Fig. 2-Cutaway View of Water Pump Assembly



1—Gasket	**7—Nipple**	**13—Nut**	**18—Cap Screw**
2—Cover	**8—Housing**	**14—Cap Screw**	**19—Washer**
3—Gasket	**9—Fan Belt**	**15—Cap Screw**	**20—Cup**
4—Impeller	**10—Fan Pulley**	**16—Belt Adjusting Strap**	**21—Insert**
5—Seal	**11—Cap Screw (2 used)**	**17—Stud**	**22—Fan Hub**
6—Bearing	**12—Lock Washer (2 used)**		

Fig. 3-Water Pump and Related Parts

Support water pump housing and allow sufficient clearance for impeller at center of support. Use a JD262-A water pump bearing driver or any tubular type driver that contacts only the outer race of bearing and press bearing assembly from housing.

Support impeller and press out bearing shaft using a drift which is slightly smaller than the bearing shaft. Remove seal from bearing shaft. Note location of cup and insert in impeller.

Inspection

Any leakage at the drain hole in bottom of housing generally indicates a leaking seal.

Assembly

Install a new seal in the pump housing. Coat outside of pump seal metal retainer with joint sealing compound and wipe off any excess (spring-loaded type seal only). Apply a thin coat of light oil to sealing lip of seal before installing.

Install by hand as shown in Fig. 2. Rubber sealing surface that contacts housing should be clean and dry.

Use a tubular type driver that contacts only the outer metal portion of the seal and press new seal (metal side first) into pump housing. Press in until metal flange bottoms on housing.

Using a JD262A water pump bearing driver or any tubular type driver that contacts only the outer race of bearing, press shaft and bearing assembly into housing until outer metal case is flush with pump housing.

Install impeller insert and cup in impeller. Place insert in cup with "V" groove on insert toward cup. Be sure parts are dry and clean. Dip cup and insert in oil and install in impeller (cup to bottom of counterbore in impeller). Insert should be flat and edge of cup uniform around insert when installed in impeller.

Support pump assembly on end of bearing shaft and press impeller (fins toward housing) into position. Impeller should be pressed in until fins are flush (within 0.010 inch [0.254 mm]) with metal rim of pump housing. Check with a straightedge and feeler gauge as shown in Fig. 4.

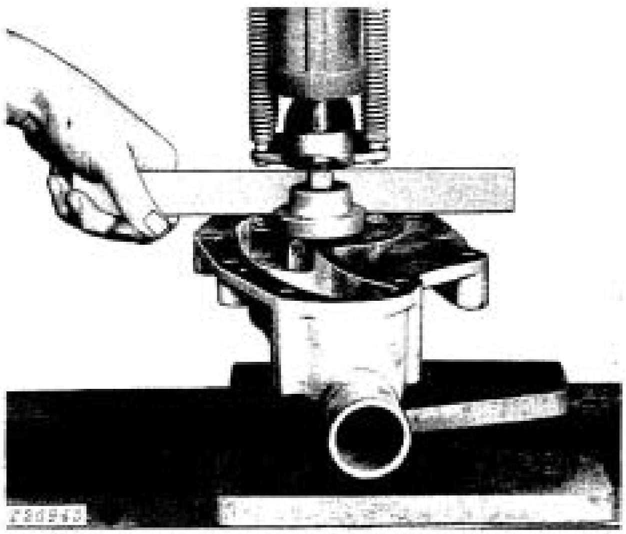


Fig. 4-Installing Impeller

Support impeller end of pump bearing shaft and press fan hub into position on opposite end of shaft.

Fan hub should be pressed onto shaft according to specifications. The distance from the fan surface on pulley-to-rear surface of water pump housing without rear plate or gasket) should be 5-1/2 inches [139.7 mm].

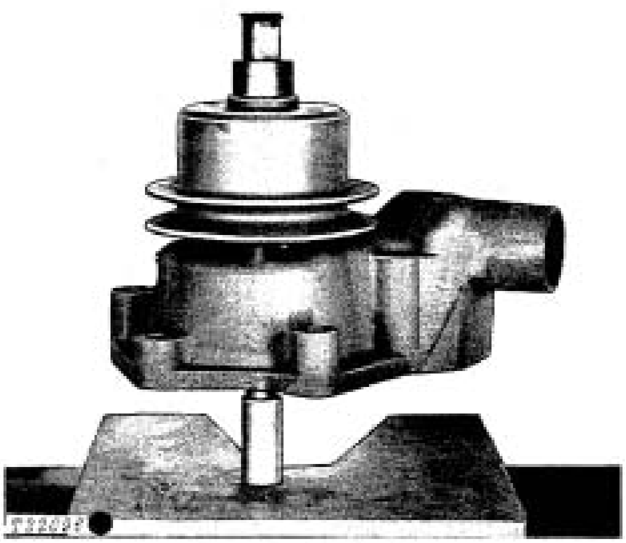


Fig. 5-Installing Fan Hub

Using a new gasket, install pump rear cover on pump assembly. Tighten attaching cap screws to 35 lb-ft [4.8 kg-m].

Installation

Follow removal procedure for the water pump in reverse order.

Install radiator on engine (see page 20-20-1) and fill cooling system with clean soft water and proper additive.

THERMOSTAT AND HOUSING

Removal

Remove cap screws holding thermostat housing to water manifold and remove housing and thermostat.

Repair

If engine has been running to cold or hot, carefully inspect the thermostat for defects. Test in hot water to check for proper opening and closing.

Thermostat should open at 180°F. [82.2°C.] for gasoline and diesel engines.

Installation

Follow removal procedure in reverse order.

Group 25
FUEL SYSTEM

GENERAL INFORMATION

The fuel system may be either diesel or gasoline. The two systems both have a fuel tank, fuel tank screen and transfer pump. The diesel also has a fuel filter, injection pump and injection nozzles. The gasoline system has a carburetor, governor and spark plugs.

The fuel tank is located in front of the engine. A finger-shaped fuel tank screen located in the bottom of the fuel tank, filters out most fuel impurities.

The transfer pump draws fuel from the tank and sends it to the diesel fuel filter or the gasoline carburetor. The transfer pump is on the left side of the engine.

The diesel fuel filter, on the right side of the engine, further filters the fuel.

The diesel injection pump located on the left side of the engine pressurizes fuel and sends it through high pressure lines to the nozzles.

The nozzles (one for each cylinder) spray fuel into the combustion chamber.

The carburetor mixes fuel and air in proper combination for combustion.

The governor regulates the fuel air mixture in the carburetor.

For information on spark plugs, see Section 30.

FUEL TANK

Removal

The removal procedure for both diesel and gasoline tanks is similar.

1 - Remove grille guard.

2 - Remove hood and grille screens.

3 - Close fuel shut-off valve.

4 - Remove fuel line from tank fittings.

5 - Disconnect fuel return line (diesel only).

6 - Separate air cleaner and auxiliary hydraulic oil reservoir from fuel tank.

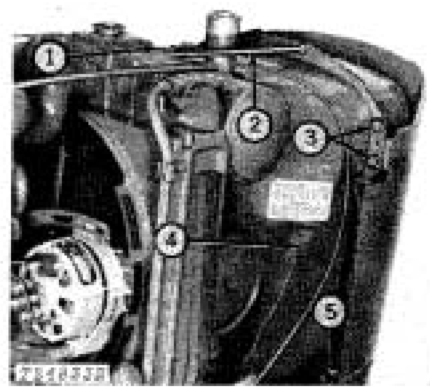
7 - Disconnect fuel gauge sender wire.

8 - Loosen fuel tank support rod.

9 - Remove cap screws from upper tank flange.

10 - Loosen cap screws forcing tank stops against lower tank flange.

11 - Lift fuel tank from tractor.



1—Fuel Return Line (diesel)
2—Top Support Rod
3—Upper Mounting Screws
4—Fuel Sender Wire
5—Tank Stop

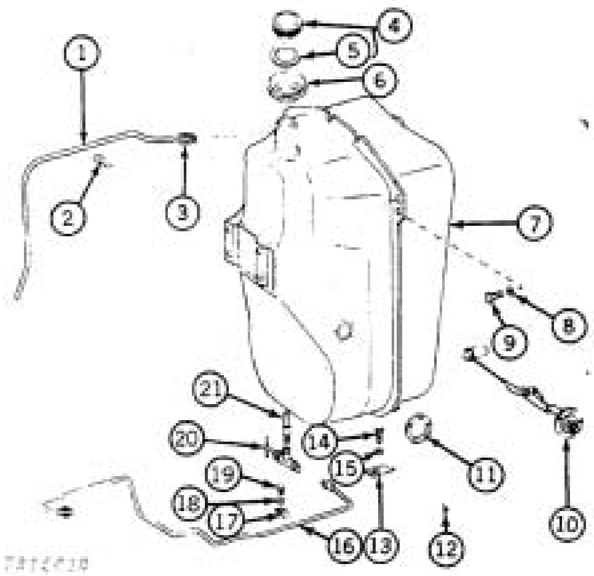
Fig. 1-Removing Fuel Tank

Repair

CAUTION: Repairing a fuel tank is very dangerous. Never permit live sparks, smoking or fire of any nature in the vicinity of fuel tank repair work.

Refer to Fig. 2 during disassembly and assembly of the fuel tank.

FOS Refer to FOS Manual - ENGINES for repair of fuel tank.



1—Leak-off Tube (diesel)
2—Clamp (diesel)
3—Connector (diesel)
4—Fuel Cap
5—Gasket
6—Grommet
7—Fuel Tank
8—Washer (4 used)
9—Cap Screw (4 used)
10—Fuel Gauge Sender
11—Gasket
12—Screw (5 used)
13—Stop (5 used)
14—Cap Screw (2 used)
15—Washer (2 used)
16—Fuel Line
17—Clip
18—Lock Washer
19—Cap Screw
20—Shut-off Valve
21—Fuel Tank Screen

Fig. 2-Fuel Tank Assembly

Installation

Follow the removal procedure in the reverse order.

IMPORTANT: Install front support end of side grille retaining spring with open end of hook facing front of tractor.

CAUTION: The fuel tank filler cap is vented for safety. Always replace it with a vented cap.

Fill tank with proper fuel.

On diesel fuel systems, bleed fuel system before operating engine.

FUEL TANK SCREEN

Removal

Drain fuel from tank.

NOTE: If fuel is to be reused, drain into clean container and keep covered.

Remove fuel shut off valve (20, Fig. 2) and fuel line (16) to transfer pump. Remove screen (21).

Repair

The screen seldom needs cleaning, because the sloshing of the fuel tends to wash dirt particles from it.

If the screen does need cleaning, wash out in clean fuel.

Replace the screen if it will not wash clean or has large holes.

Installation

Follow removal procedure in reverse order.

Fill tank with proper fuel.

On diesel fuel systems, bleed fuel system before operating engine.

FUEL FILTER (DIESEL)

Removal

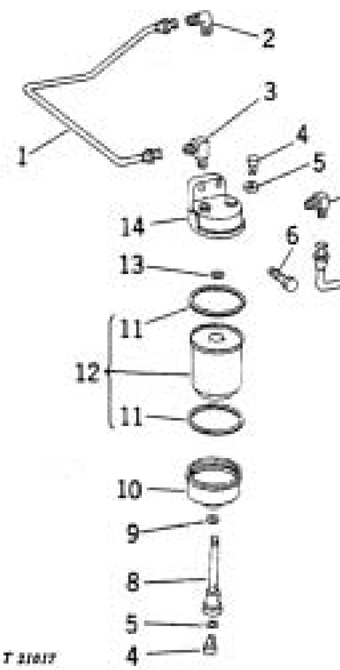
Remove filter element by backing off large screw under filter bowl and removing bowl and stud. Pull off element.

Repair

Clean out filter bowl.

Replace element whenever it is necessary.

Refer to Fig. 3 during disassembly and assembly.



1—Fuel Line
2—Elbow
3—Elbow
4—Plug (2 used)
5—O-Ring (2 used)
6—Cap Screw (2 used)
7—Fuel Line
8—Special Screw
9—Gasket
10—Sediment Bowl
11—Gasket (2 used)
12—Element with Gasket
13—O-Ring
14—Filter Head

Fig. 3-Fuel Filter

Installation

Follow removal procedure in reverse order.

Bleed the fuel system.

FUEL TRANSFER PUMP

Removal

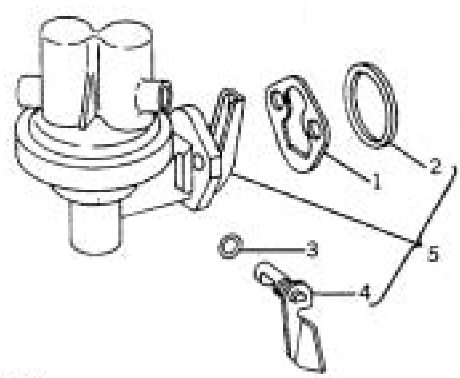
Close fuel shut off valve at tank.

Disconnect fuel lines at pump. Remove cap screws and remove pump.

Repair

Refer to Fig. 4 when disassembling and assembling the fuel transfer pump.

To remove or install primer lever (diesel), compress rocker arm lever.



T23206N

1—Gasket
2—Packing
3—O-Ring (diesel)
4—Primer Lever (diesel)
5—Fuel Pump

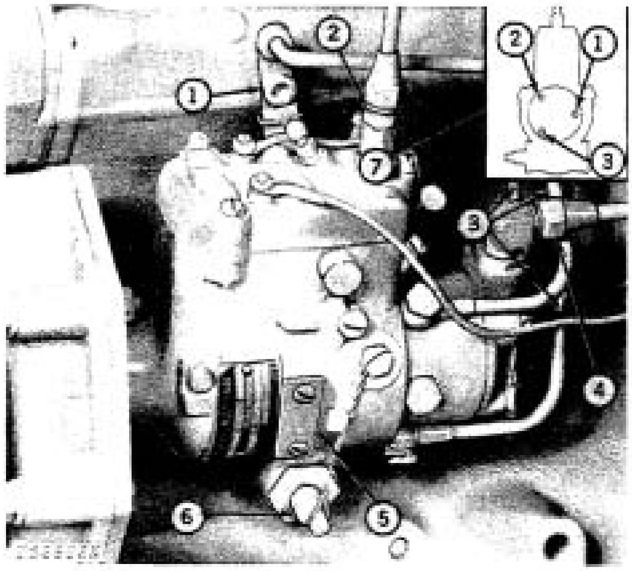
Fig. 4-Fuel Transfer Pump

Installation

Follow removal procedure in reverse order. Bleed diesel fuel system.

FUEL INJECTION PUMP

Removal



1—Throttle Linkage
2—Fuel Return
3—Injection Lines
4—Fuel Inlet
5—Timing Hole Cover
6—Cam Advance Mechanism
7—Injection Delivery Sequence (View from end plates)

Fig. 5-Fuel Injection Pump

CAUTION: Escaping diesel fuel under pressure can have sufficient force to penetrate the skin causing serious personal injury. Before disconnecting lines be sure to relieve all pressure.

Fuel escaping from a very small opening can be almost invisible. Use a piece of cardboard or wood, rather than hands to check for escaping fuel.

If injured by escaping fuel, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered immediately.

To relieve pressure in the fuel system, slightly crack high pressure supply lines at injection nozzles.

Before removing fuel injection pump, thoroughly clean the pump, fittings, and all connections to be disconnected.

IMPORTANT: Never spray cold water on or steam clean a warm injection pump.

The fuel injection pump and engine should be static timed before the injection pump is removed (see "Installation").

Removing Injection Pump From Drive Shaft

Disconnect fuel supply, fuel return, and the injection lines from the pump. Plug all openings.

Disconnect the throttle linkage and wire throttle lever in wide open position before removal of pump to prevent loosening of internal parts.

Remove the pump mounting nuts and slide the pump in a straight line away from the engine.

The pump drive gear and shaft will remain on the engine front plate.

Removing Injection Pump, Drive Shaft and Gear

NOTE: The injection pump drive shaft can be removed without removing the timing gear cover. Remove injection pump gear cover. Remove thrust spring and pin from gear end of shaft. Loosen pump drive shaft nut until it is flush with end of shaft. Drive shaft from the front using a brass drift. Completely remove nut from end of shaft and remove shaft from gear. Care should be taken to avoid dropping Woodruff key when removing shaft. Install by placing the shaft in the gear and tightening the attaching nut, drawing the shaft through the gear. Tighten nut to 45 lb-ft [6.2 kg-m].

If it is desired to remove the pump drive gear and shaft from the engine with the pump, the timing gear cover must be removed (see Group 10).

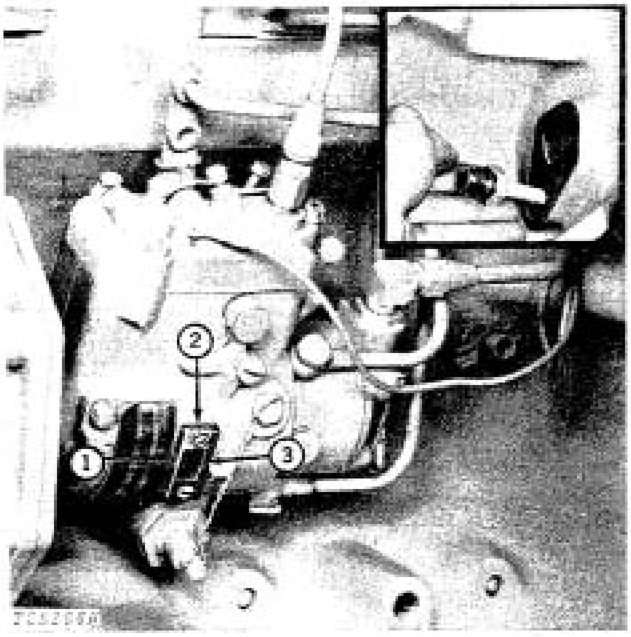
Clean the injection pump and lines. Align the timing marks on the pump and insert the timing screw in flywheel.

With timing gear cover removed, check to see that the injection pump gear is properly timed to the crankshaft (see Group 10).

Remove the upper idler gear.

Remove injection pump drive gear and shaft.

Remove pump mounting hex. nuts and remove pump from engine.

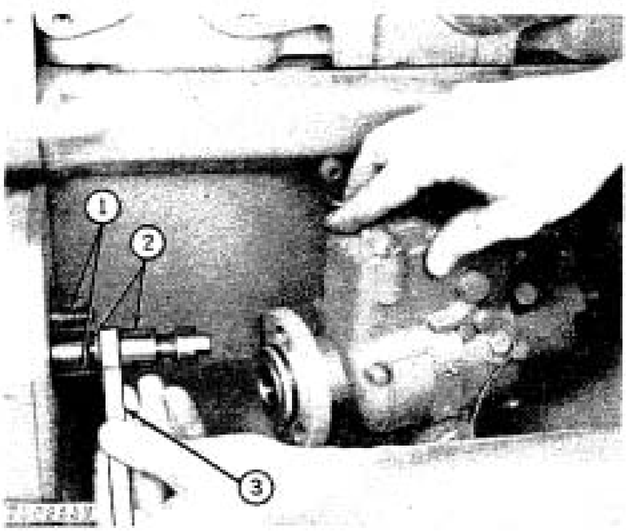


1—Governor Weight Retainer Timing Line
2—Timing Window
3—Cam Timing Line

Fig. 6-Timing Lines

Install pump over shaft, making sure that reference mark on drive shaft tang aligns with mark on the slot end of the distributor rotor in the pump.

Incorrect assembly of shaft into pump will result in timing error of 180 degrees.



1—Mounting Studs
2—Seals
3—Seal Compressing Tool

Fig. 7-Compressing Drive Shaft Seal

Repair

For detailed information and specifications refer to John Deere Service Manual SM-2045, "Testing and Servicing Fuel Injection Pumps and Nozzles."

Drive Shaft and Gear

Remove thrust spring and pin from gear end of shaft.
Loosen nut until flush with end of shaft.
Remove nut and gear from shaft.
Inspect gear for wear or chipped teeth.
Inspect tang on drive shaft for a minimum width of 0.305 inch (7.747 mm).

Check seals on drive shaft for hardness or cracked condition. Examine seal grooves on shaft for smooth finish. Any roughness at these points will cause seal failure.

Apply a generous coat of Lubriplate or equivalent to the drive shaft seals and slide seals into grooves using drive shaft seal installation tool (13369). The seals must face in opposite directions. Apply Lubriplate or equivalent liberally around the shaft between seals.

Install gear on drive shaft using key and keyway to locate gear on shaft. Tighten hex. nut to 35 lb-ft (4.8 kg-m).

Installation and Timing

IMPORTANT: Modification or alteration of the injection pump, the injection pump timing, or the fuel injection nozzles in ways not recommended by the manufacturer will terminate the warranty obligation to the purchaser.

If removed, install injection pump gear and shaft on engine front plate. See Group 10 of this section for timing injection pump gear.

Install engine timing gear cover if removed.

With timing window (JD259-13366) in place check to be sure that timing line on weight retainer hub registers with line on the cam (Fig. 6).

If engine has not been set on "top dead center" (No. 1 cylinder on compression stroke) rotate engine in direction of rotation (counterclockwise as viewed from flywheel end) until No. 1 cylinder is on compression stroke. Insert timing pin in flywheel as the flywheel is rotated and comes in registry (inset, Fig. 6). Engine is now set at "top dead center."

Using drive shaft seal compressing tool (JD256-13371), compress seal on shaft and slide pump in place (Fig. 7).

IMPORTANT: Do not turn drive shaft seal over while installing. If resistance is felt, stop and check position of seal. If seal has been forced back, replace seal.

Install hex. nuts and tighten finger tight. Rotate pump first in the direction of rotation (counterclockwise as viewed from flywheel end) and then in the opposite direction and again register timing lines to take up all backlash. Tighten mounting nuts securely.

Recheck pump timing.

Connect injection lines using new washers. Tighten connections to 35 lb-ft (4.8 kg-m).

IMPORTANT: Do not use washers other than those specified in the parts catalogs since other washers may allow injection screws to bottom on hydraulic head and cause pump seizure.

Connect fuel supply and return lines. Tighten connections to 20 lb-ft (2.8 kg-m).

Connect throttle linkage.

Remove timing window and install timing window cover.

Bleed fuel system.

Refer to Group 10 Section 70 for speed control adjustment and injection pump advance adjustment.

Bleeding

Any time the engine has been idle for a long period or the fuel system has been cleaned, bleed the fuel system before operation to remove trapped air.

1. Fill tank with proper fuel.

2. Open shutoff valve at tank outlet.

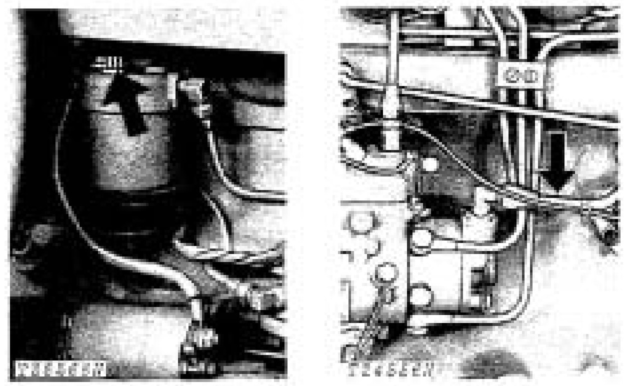


Fig. 8-Bleed Plug (Left) and Inlet Line (Right)

3. Loosen bleed plug on top of fuel filter. Pump primer lever until a solid stream of fuel (free of air bubbles) flows from the opening. Tighten plug.

4. Loosen pump inlet line. Pump primer lever until a solid stream of fuel (free of air bubbles) flows from line. Retighten line.

5. Be sure to leave primer lever at lowest point of stroke.

FUEL INJECTION NOZZLES

Removal

Remove the tractor hood.

Clean the cylinder head area around the nozzles and blow off the compressed air. Use hose clamp pliers (JDE49) to loosen clamp on leakoff boot and slip off boot. Remove the return leakoff line with the boots.

CAUTION: Escaping diesel fuel under pressure can have sufficient force to penetrate the skin causing serious personal injury. Before disconnecting lines be sure to relieve all pressure.

Fuel escaping from a very small opening can be almost invisible. Use a piece of cardboard or wood, rather than hands to check for escaping fuel.

If injured by escaping fuel, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered immediately.

To relieve pressure in the fuel system slightly crack high pressure supply lines at injection nozzles.

Use a wrench to hold nut on injector and unscrew the nut on fuel supply line. Cap openings as soon as lines are disconnected.

Remove nozzle clamp cap screws and spacer. Withdraw nozzle from cylinder head. If nozzles cannot be easily removed from cylinder head, use a JDE38 Nozzle Puller to remove them. Use care when attaching the puller to the nozzle. Operate puller so as to pull nozzles straight out of the bores.

IMPORTANT: Do not use a screwdriver or similar tool to pry injector nozzles from cylinder head as distortion and permanent damage to nozzles may occur. Injectors are easily removed by hand unless lower carbon seal has failed, allowing nozzle to become "set." In this case, the nozzle puller must be used.

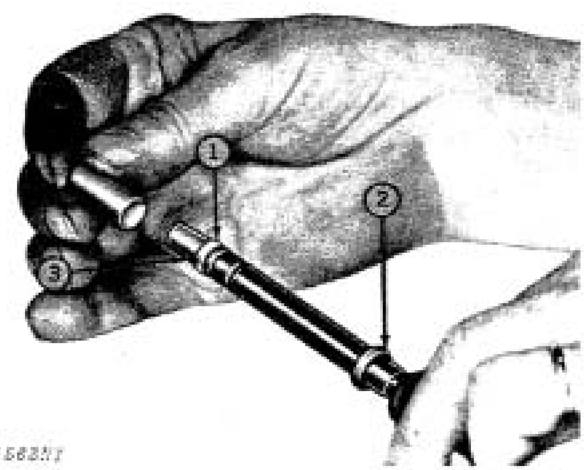
Repair

IMPORTANT: Do not attempt to test or disassemble nozzles unless the proper service tools are available. Service Manual SM-2045 "Testing and Servicing Fuel Injection Pumps and Nozzles" contains specifications, special service tools, and testing procedures necessary to service the Roosa-Master injection nozzles.

Installation

Install a new sealing washer onto the nozzle body. Use No. 16477 pilot tool to install a new carbon stop seal (Fig. 10). Place the pilot on the spray tip of the nozzle and work the seal down over the pilot onto the nozzle body, then into its groove.

Fig. 9-Using Nozzle Puller to Remove Nozzles



1—Carbon Seal
2—Seal Washer
3—Pilot

Fig. 10-Installing Sealing Washer and Carbon Stop Seal

Using a JDE39 Nozzle Bore Cleaning Tool, clean out the nozzle bores in the cylinder head. When using the tool, gradually turn it into the bore.

NOTE: Always turn the tool clockwise as turning it counterclockwise will dull the tool.

After the bores are clean, blow out with compressed air. Be sure nozzle gasket mounting surface on cylinder head is free from burrs or dirt. Foreign material in this area could cause the nozzle body to distort when clamped down, resulting in a sticking valve.

Unplug holes in cylinder head and insert the nozzle into the cylinder head bore using a twisting motion.

NOTE: Be sure nozzle body is free from oil or grease when installing.

Turn injector locating clamp until forks fit down over inlet line. Install cap screw and leaf spring around head of injector and position round spacer on end of cap screw under leaf spring. Hand tighten cap screw. Connect inlet line and hand tighten.

Tighten nozzle hold-down cap screws to 20 lb-ft [2.8 kg-m] and install leak-off boots and line.

Fig. 11-Tightening Injector Lines

Crank engine with starter until fuel flows around loose injector lines. **Using one hand and two wrenches,** tighten injector lines as shown in Fig. 11. Use only enough force to keep lines from leaking. Start engine and check for leaks around nozzle connections. Retighten if necessary and install hood.

CARBURETOR

Removal

Disconnect solenoid lead from wiring harness.

Disconnect linkage rod from governor.

Loosen two hose clamps from air intake-to-carburetor hose and remove hose.

Shut off fuel supply at fuel tank and disconnect fuel line at carburetor.

Push choke control button in and disconnect choke wire and cable.

Remove two cap screws holding carburetor to intake manifold.

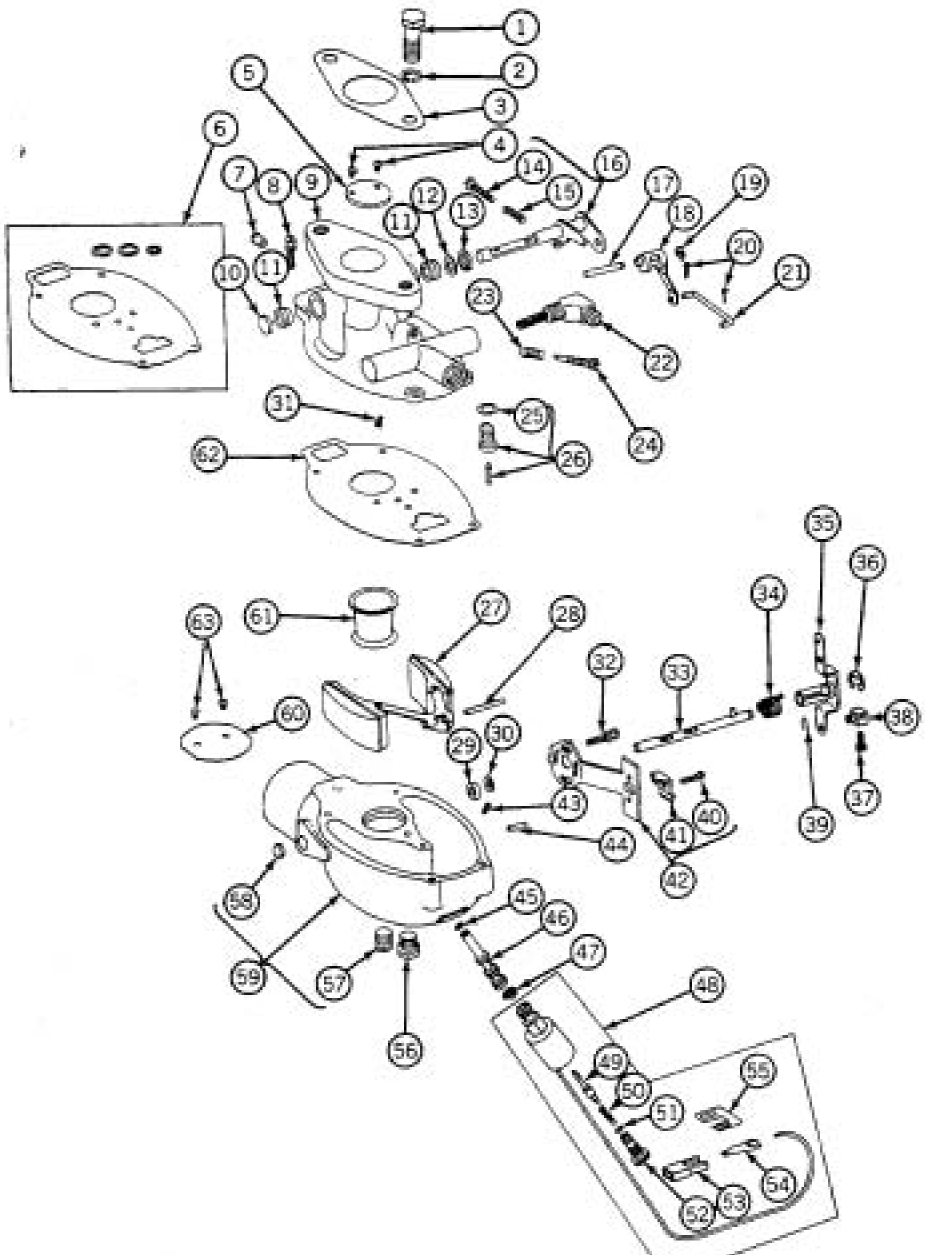
Repair

Disassembly

Before diassembling carburetor study Fig. 12.

Strainer screen is part of elbow (22, Fig. 12). Be careful when removing elbow.

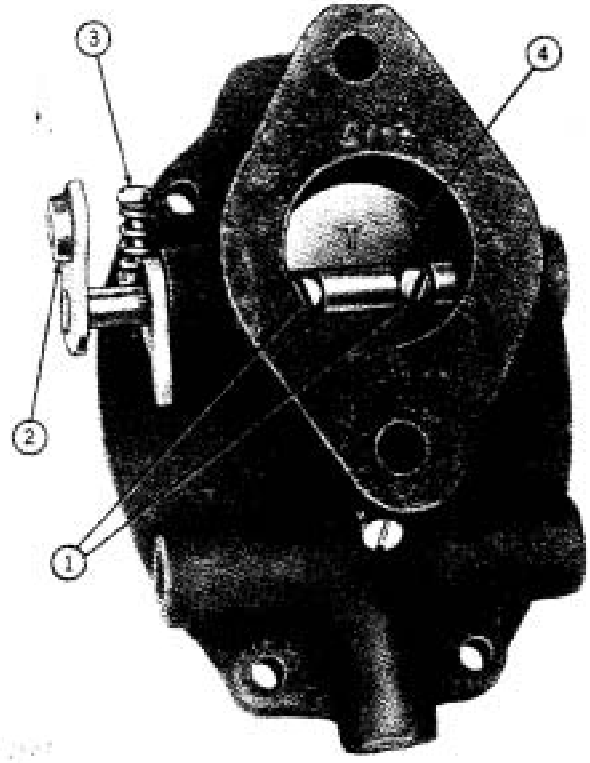
When removing solenoid, apply torque to hex. portion only.



1—Cap Screw (2 used)
2—Lock Washer (2 used)
3—Gasket
4—Screw (2 used)
5—Throttle Fly
6—Gasket Set
7—Nameplate Plug
8—Screw (4 used)
9—Throttle Body
10—Throttle Shaft Cup
11—Throttle Shaft Bearing (2 used)
12—Throttle Shaft Packing
13—Retainer
14—Machine Screw
15—Spring
16—Throttle Shaft Assembly
17—Fast Idle Lever Pin
18—Fast Idle Cam Lever
19—Snap Ring
20—Cotter Pin (2 used)
21—Fast Idle Link
22—Strainer and Elbow
23—Spring
24—Idle Adjusting Needle
25—Gasket
26—Valve Assembly
27—Float and Lever Assembly
28—Float Shaft
29—Packing
30—Washer
31—Idle Jet
32—Screw (2 used)
33—Choke Shaft Assembly
34—Spring
35—Choke Lever
36—Retainer
37—Screw
38—Choke Swivel
39—Snap Ring
40—Screw
41—Choke Bracket Clip
42—Choke Bracket Assembly
43—Power Jet
44—Spring Pin
45—Nozzle Gasket
46—Main Nozzle
47—Gasket
48—Solenoid Assembly
49—Load Needle
50—Spring
51—O-Ring
52—Load Adjusting Screw
53—Male Terminal
54—Terminal Connector
55—Clip
56—Drain Plug
57—Plug
58—Choke Shaft Plug
59—Bowl
60—Fly Choke
61—Venturi
62—Gasket
63—Screw (2 used)

Fig. 12-Carburetor

Inspection and Cleaning

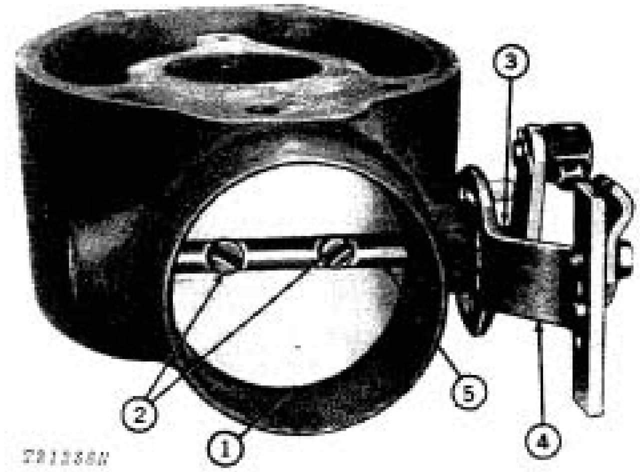


1—Throttle Fly Screws
2—Throttle Shaft and Lever
3—Throttle Stop Screw
4—Throttle Fly

Fig. 13-Throttle Assembly

Place throttle fly in closed position (Fig. 13) and check for wear on valve and throttle bores. If fly is burred or distorted, replace with new fly.

Place the choke fly in closed position (Fig. 14). If fly is burred or distorted, replace fly.



1—Choke Fly
2—Choke Fly Screws
3—Choke Relief Spring
4—Choke Bracket
5—Choke Shaft

Fig. 14-Choke Assembly

Check tension of choke relief spring. The spring should be sufficiently taut to close choke with a snap.

Dispose of all parts that are replaced by new parts in the carburetor repair kit.

Check all parts. Replace if worn or damaged.

All other parts should be soaked in a carburetor cleaner until all foreign material has been removed.

IMPORTANT: Never clean holes or passageways with small drills or wire, as a slight enlargement or burring of these holes will change the performance of the carburetor. No method of cleaning other than solvent should be used.

Dry all parts with compressed air, making sure all holes are open and free of carbon and dirt.

IMPORTANT: Never use compressed air to clean a completely assembled carburetor. To do so will cause the float to collapse.

Replacing Needle Bearings

1. Remove throttle shaft (16, Fig. 12), packing (12), and retainer (13).

2. Insert the bearing-removing tool (Fig. 15).

3. Spread the lips of the tool apart with a small screwdriver so the tool will seat firmly inside the rolled edge of the bearing. Press out bearing.

4. Press in new bearings flush with shoulder of driving tool.

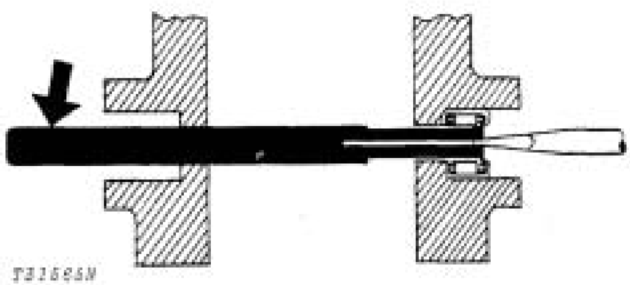


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Fig. 15-Bearing Removal Tool M-504 in Position

Assembly

Refer to Fig. 12 when assembling the carburetor.

When assembling carburetor, note the following:

1. When installing solenoid, apply torque to hex. portion only.

2. Be sure that the throttle fly screws are tight. If they are not secure, suction from the engine will draw them into the combustion chamber.

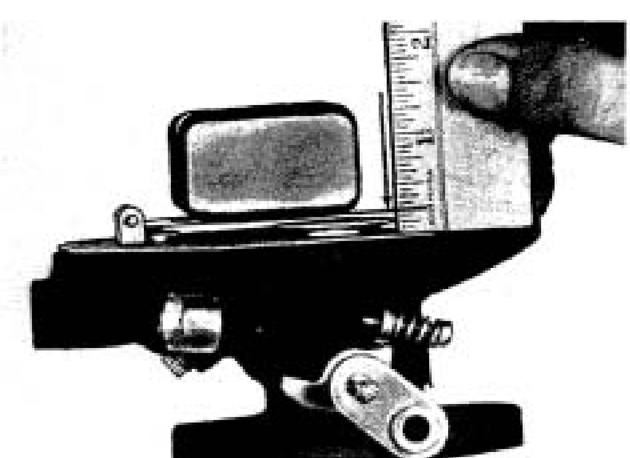

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Fig. 16-Correct Float Position

3. Do not force idle adjusting needle too firmly against seat, as it will groove the idle seat and prevent proper adjustment.

4. Invert throttle body assembly and measure the distance between both halves of the float and the bowl gasket (Fig. 16). If float is not 1/4 inch [6.35 mm] from bowl gasket, use float bending tool (M-8) and adjust to correct height.

Preliminary Adjustments

Prior to installation of the carburetor on the unit perform the following so that engine will start and run.

1. Bottom load adjusting screw and back out two turns.

2. Bottom idle needle and back out one turn.

FOS

To adjust the carburetor once the engine has been started refer to FOS Manual-ENGINES, "Gasoline Fuel Systems."

Installation

Secure carburetor to manifold.

Connect solenoid lead to wiring harness and fuel line to carburetor.

Move the governor control lever and linkage rod forward as far as possible. Move the carburetor throttle lever to the wide open position. Install the throttle rod on the governor lever and adjust one turn short.

Connect air cleaner hose to carburetor making sure there are no leaks between carburetor and air cleaner.

Push choke control button in and attach choke wire and cable. Be sure the choke fly is in full open position before tightening screws on choke cable.

GOVERNOR

Removal

Disconnect governor linkage.

Remove cap screws securing governor to engine. Pull governor off.

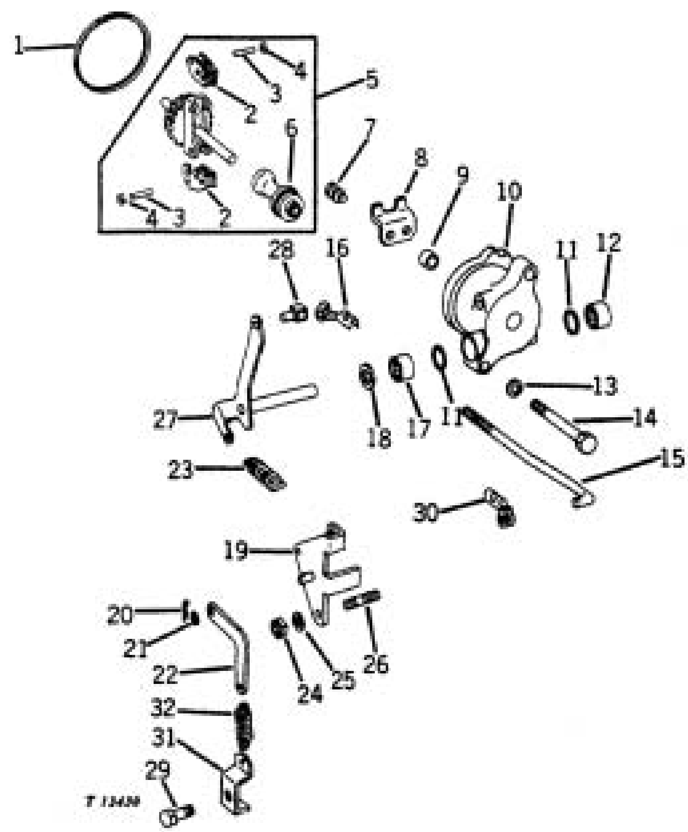
Repair

Disassemble governor assembly. Refer to Fig. 17.

To remove needle bearings (17) and (12), drive from outside governor boss to inside governor case. Use JD241 Tool to remove open end needle bearing (17) and JD245 Tool to remove closed needle bearing (12).

Inspection

Inspect bushing (9) in governor body. Bushing is located properly when seated against back of bore in governor case. Install new bushing using JD-240 tool (Fig. 18).



1—Packing
2—Weight (2 used)
3—Special Pin (2 used)
4—Retainer (2 used)
5—Weight Carrier Assembly
6—Thrust Bearing
7—Screw with Washer (2 used)
8—Yoke
9—Bushing
10—Housing
11—Thrust Washer (2 used)
12—Needle Bearing (Closed)
13—Washer (2 used)
14—Cap Screw (2 used)
15—Throttle Rod
16—Clevis Clip (2 used)
17—Needle Bearing (Open)
18—Oil Seal
19—Lever
20—Cotter Pin
21—Washer
22—Arm
23—Spring (9 coil)
24—Lock Nut
25—Washer
26—Stud
27—Lever with Shaft
28—Swivel
29—Cap Screw
30—Clevis Clip
31—Bracket
32—Spring (11 coil)

Fig. 17-Exploded View of Governor Assembly

Fig. 18-Governor Bushing Installation

Examine feet of weights (portion which bears against thrust bearing). If curved surface has flat spots worn on it, weights should be replaced. This is the most frequent cause of governor failing to open throttle at rated speeds or failing to operate properly. Replace all worn or damaged parts as necessary.

Check all other parts. Contact surface of moving parts must be smooth. If there are indications of wear, replace parts.

Assembly

Install needle bearing (17) in governor housing with numbered end of bearing toward driver JD241. Press bearing in flush with inside of housing.

Coat sealing lip of new oil seal (18) with Lubriplate and install with lips inward to flush with housing.

Before installing needle bearing (12), coat outside surface with sealing compound. Drive on closed side of bearing using JD245 Tool until flush with inside of housing.

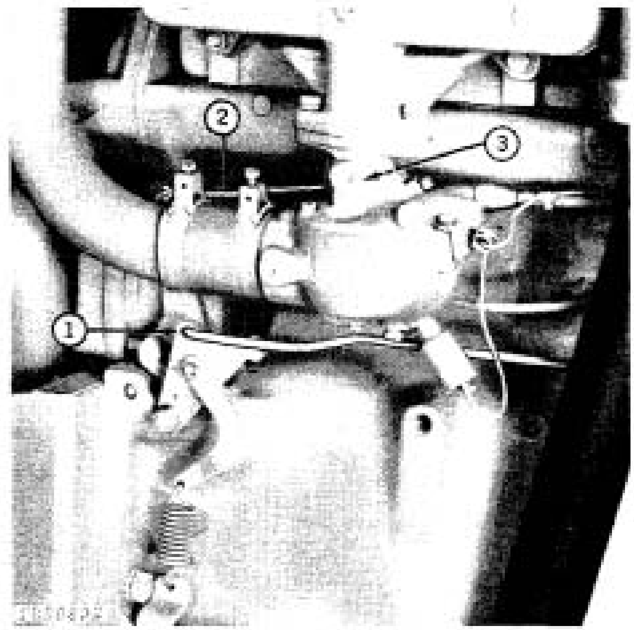
Weights must be free on pins but pins must be tight in weight carrier.

After weights are assembled to weight carrier, hold assembly horizontal and rotate shaft slowly to be sure governor weights are free on pins. As shaft is rotated, weights should fall away from shaft under their own weight.

Installation

Position new packing (1) on flange of governor body.

Install governor assembly into position on engine (Fig. 19). Be sure housing is seated properly before tightening attaching hardware.



1—Governor Lever and Shaft Assembly
2—Throttle Rod
3—Throttle Lever

Fig. 19-Governor Linkage

Move the governor control lever and shaft assembly forward as far as possible. Move the carburetor throttle lever to the wide open position.

Install the throttle rod on the governor lever and adjust one turn short.

Install speed control spring in hole on top flange of governor lever. Connect spring to counterbalance arm.

Group 30
SPEED CONTROL LINKAGE

GENERAL INFORMATION

Refer to Group 10, Section 70 for information on Speed Control Linkage.

Group 35
AIR INTAKE SYSTEM

GENERAL INFORMATION

The air intake system consists of the air cleaner and the gasoline intake manifold.

Dirty air entering the air cleaner flows first past the filter fins which separate dirt from the air and deposit the dirt in the dust unloading valve. Air is filtered when it passes through the filter element before flowing to the engine.

A pre-cleaner (Fig. 2) may also be included in the air intake system. Its purpose is to stop any large dirt particles from entering the system.

A restriction indicator (Fig. 3) may be installed to warn the operator whenever excessive restriction is present in the air intake system.

The intake manifold on gasoline engines carries the air-fuel mixture from the carburetor to the engine combustion chambers.

AIR CLEANER

Removal

Remove engine side screen.

To remove filter element, loosen the special screw and remove cover. Pull out element.

To remove air cleaner assembly, follow above procedures and remove intake hoses and attaching cap screws.

Repair

Replace any air hoses that are cracked or damaged.

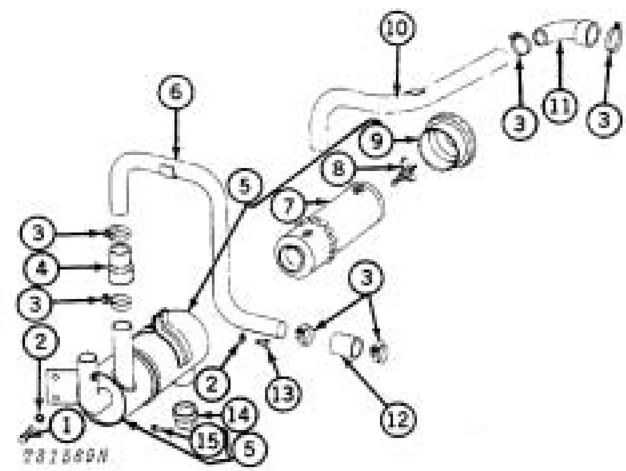
Replace element every 200 hours of operation, or sooner if necessary.

Replace the filter element (1) if damaged, (2) after one year of service, or (3) if element is not responding to cleaning, indicated by excessive smoke or loss of power.

FOS

Refer to FOS Manual - ENGINES for information on cleaning air cleaner elements.

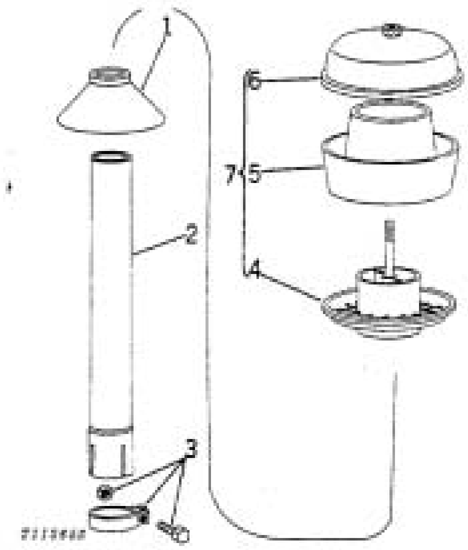
Refer to Fig. 1 during disassembly and assembly of air cleaner.



1—Cap Screw (2 used)
2—Lock Washer (3 used)
3—Hose Clamp (4 used)
4—Front Hose
5—Air Cleaner
6—Intake Pipe (gasoline)
7—Element
8—Special Screw
9—Cover
10—Intake Pipe (diesel)
11—Intake Hose (diesel)
12—Intake Hose (gasoline)
13—Cap Screw
14—Unloader Valve
15—Pipe Plug (without restriction indicator)

Fig. 1-Air Cleaner

NOTE: Never operate engine without filter element and dust unloading valve in place.



1—Seal
2—Air Stack
3—Clamp with Screw
4—Base
5—Bowl
6—Cover
7—Pre-Cleaner Assembly

Fig. 2-Pre-Cleaner (diesel shown)

The air restriction indicator (Fig. 3) can be tested for proper operation. See Group 10, Section 70 for testing instructions.

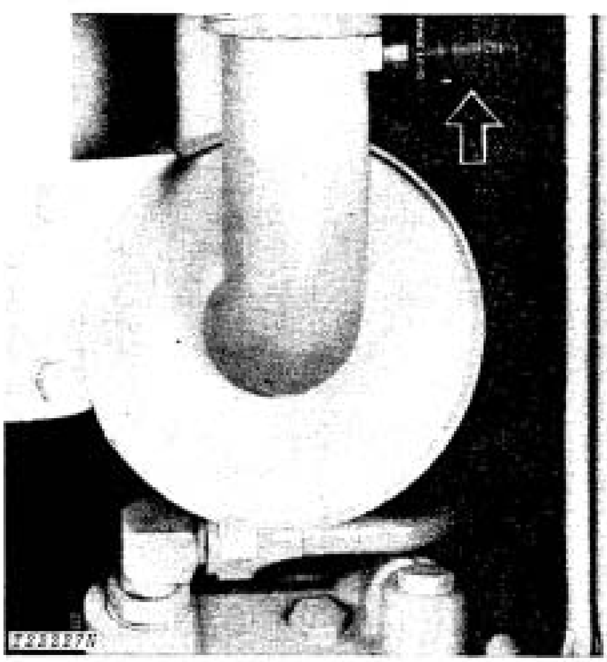


Fig. 3-Air Restriction Indicator

Installation

Follow removal procedure in reverse order.

Check all air intake system fittings for possible air leaks.

INTAKE MANIFOLD (GASOLINE)

Removal

Remove hood and muffler.

Remove cap screws and hex nuts securing manifold to carburetor and engine block.

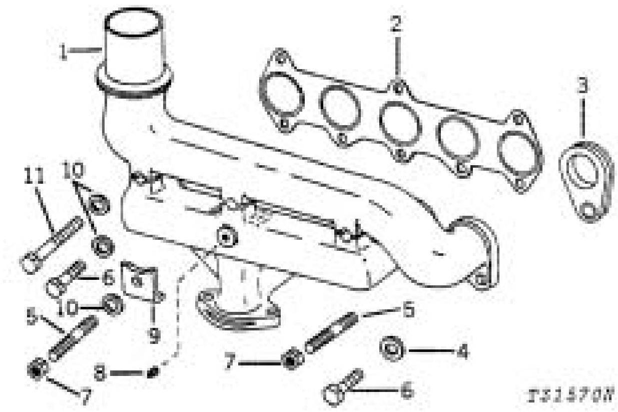
Remove manifold

Repair

Clean all air passages.

Check manifold for cracking or weak spots.

Refer to Fig. 4 during disassembly and assembly.



1—Manifold
2—Gasket
3—Gasket
4—Washer
5—Stud (2 used)
6—Cap Screw (3 used)
7—Nut (2 used)
8—Pipe Plug
9—Clamp
10—Washer (8 used)
11—Cap Screw

Fig. 4-Intake Manifold

Installation

Using new gaskets, position manifold on carburetor to 35 lb-ft (4.8 kg-m) and engine block.

Install and securely tighten attaching cap screws.

Install muffler and hood.

Run engine to bring it up to normal operating temperature.

Loosen each intake and exhaust manifold cap screw; retighten cap screw to 35 lb-ft (4.8 kg-m).

INTAKE MANIFOLD (DIESEL)

Installation

Apply John Deere Gasket Maker, or equivalent, to air inlet cap screw threads.

Group 40
SPECIFICATIONS AND SPECIAL TOOLS

ENGINE REMOVAL AND INSTALLATION

SPECIFICATIONS AND TORQUE VALUES

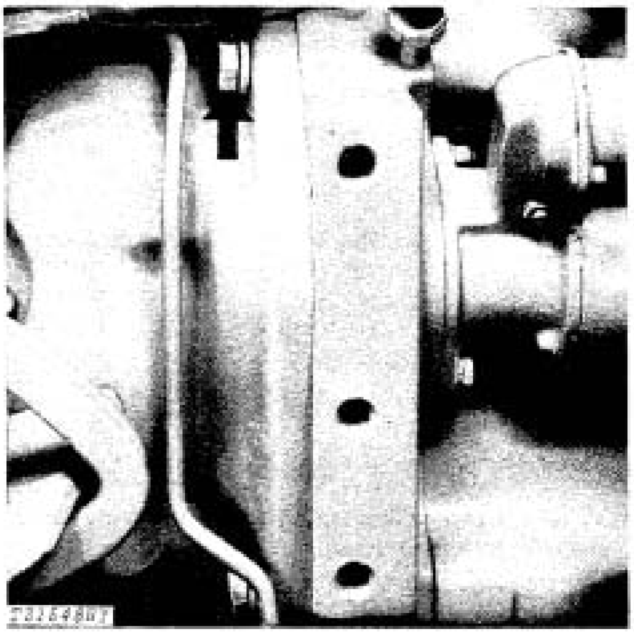


Fig. 1-Engine to Clutch Housing Cap Screws

Engine to clutch housing cap screw
torque .... 250 lb-ft
(34.56 kg-m)

ENGINE REMOVAL AND INSTALLATION

SPECIAL TOOLS

Convenience Tools

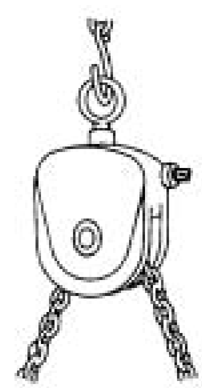
Tool	Tool Number	Use
	D01043AA	Load Positioning Sling—To remove and install engine in unit. Comes with one set of JDG-19 Lifting Bracket.

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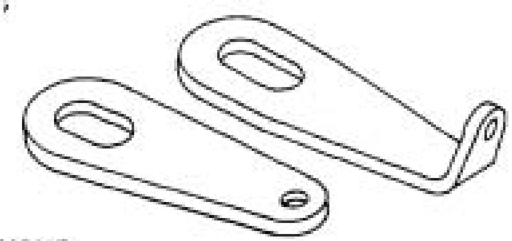
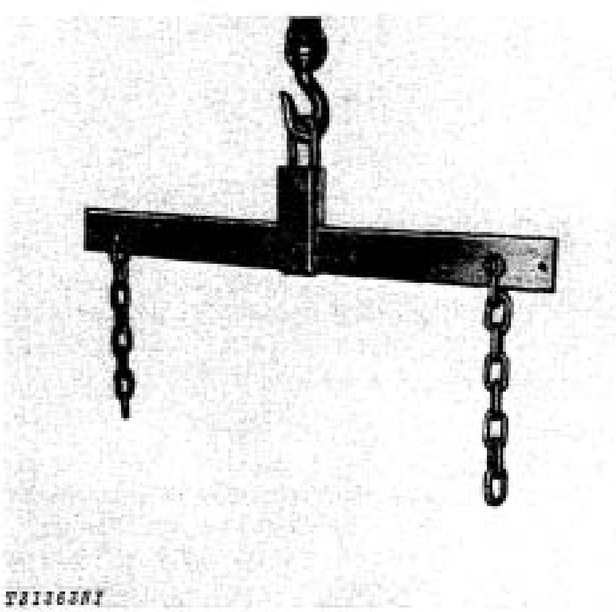
Fig. 2-Load Positioning Sling

ENGINE REMOVAL AND INSTALLATION

SPECIAL TOOLS—Continued

Tool	Tool Number	Use
 T313646 *Fig. 3-Lifting Brackets and Lifting Eyes*	JD-244	Lifting Eyes—For engine removal.
 T547259 *Fig. 4-Lifting Brackets*	JDG-19	Lifting Bracket—For engine removal and installation.
 T8136381 *Fig. 5-Engine Lifting Sling*	JDG-23 or JDG-1	Engine Lifting Sling—To remove engine.

BASIC ENGINE

SPECIFICATIONS AND TORQUE VALUES

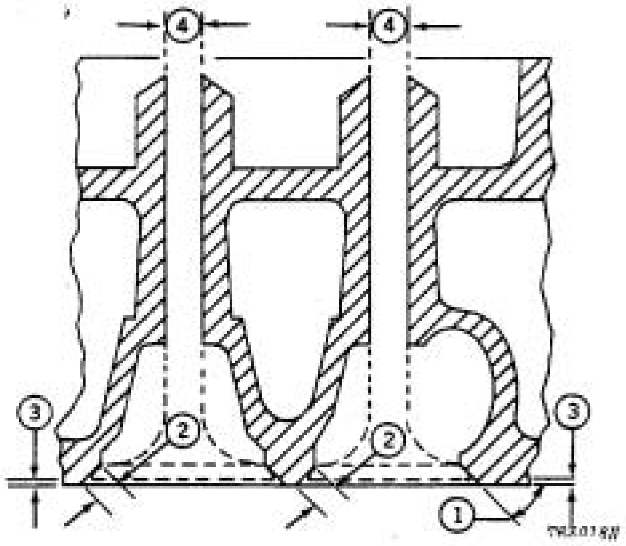


Fig. 6-Cylinder Head

1 - Angle of valve seat (diesel and gasoline)
  (a) intake .... 45°
  (b) exhaust .... 45°

2 - Width of valve seat
  (a) diesel .... 0.0781 to 0.0937 in. (1.984 to 2.380 mm)
  (b) gasoline .... 0.0625 to 0.0781 in. (1.588 to 1.984 mm)

3 - Distance closed valve to head deck (diesel)
  (a) intake .... 0.037 ± 0.007 in. (0.94 ± 0.18 mm)
  (b) exhaust .... 0.057 ± 0.007 in. (1.45 ± 0.18 mm)

4 - Inside diameter of valve guide (diesel and gasoline) .... 0.3745 to 0.3755 in. (9.512 to 9.538 mm)
  Valve stem to guide clearance (diesel and gasoline) .... 0.0020 to 0.0040 in. (0.051 to 0.102 mm)
  Wear tolerance (diesel and gasoline) . . 0.002 in. (0.05 mm)

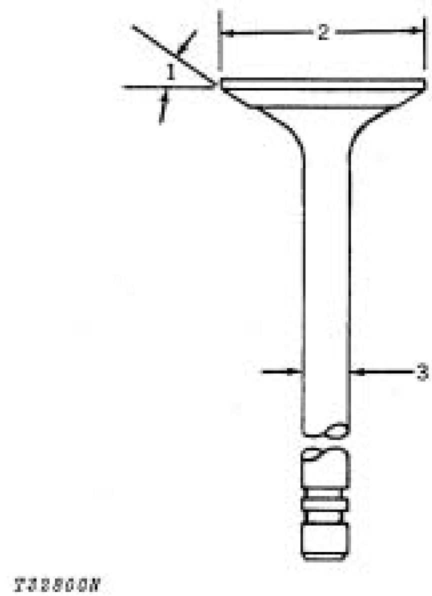


Fig. 7-Valve

1 - Angle of valve face (diesel and gasoline)
  (a) Intake .... 44.5°
  (b) Exhaust .... 44.5°

2 - Outside diameter of valve head

-diesel-

  (a) intake .... 1.7670 to 1.7770 in. (44.882 to 45.136 mm)
  (b) exhaust .... 1.5700 to 1.5800 in. (39.878 to 40.132 mm)

-gasoline-

  (a) intake .... 1.7670 to 1.7770 in. (44.882 to 45.136 mm)
  (b) exhaust .... 1.4520 to 1.4620 in. (36.881 to 37.135 mm)

3 - Outside diameter of valve stem (diesel and gasoline) .... 0.3715 to 0.3725 in. (9.436 to 9.462 mm)
  Oversize valves available (diesel and gasoline) .... 0.003, 0.015 and 0.030 in. (0.07, 0.38 and 0.76 mm)

BASIC ENGINE

SPECIFICATIONS AND TORQUE VALUES—Continued

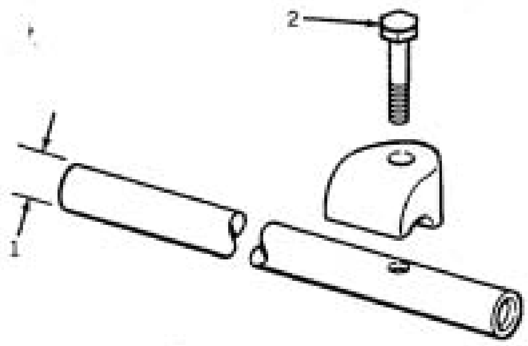


Fig. 8-Rocker Arm Shaft and Clamp

1 - Outside diameter of rocker arm shaft (diesel and gasoline) ...... 0.7859 to 0.7889 in. (19.961 to 20.038 mm)
Additional wear tolerance .... 0.0020 in. (0.0508 mm)

2 - Rocker arm shaft clamp to head cap screw torque .... 55 lb-ft (7.6 kg-m)

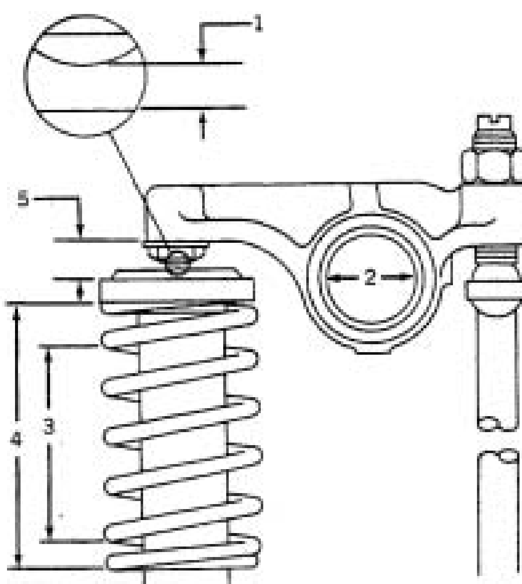


Fig. 9-Valve Spring and Rocker Arm

1 - Valve clearance

-diesel-

(a) exhaust .... 0.018 in. (0.46 mm)
(b) intake .... 0.014 in. (0.35 mm)

-gasoline-

(a) exhaust .... 0.022 in. (0.56 mm)
(b) intake .... 0.014 in. (0.35 mm)

2 - Inside diameter of rocker arm bore (diesel and gasoline) ...... 0.7900 to 0.7920 in. (20.066 to 20.117 mm)
Wear tolerance .... 0.0020 in. (0.051 mm)

3 - Valve spring length, valve open (diesel and gasoline) .... 1.36 in. (34.5 mm) at 133-153 lb. (60.3-68.9 kg)

4 - Valve spring length, valve closed (diesel and gasoline) .... 1.81 in. (46.0 mm) at 54-62 lb. (24.50-28.12 kg)

5 - Valve lift (clearance adjusted)
(a) diesel
exhaust .... 0.456 to 0.482 in. (11.58 to 12.24 mm)
intake .... 0.460 to 0.490 in. (11.68 to 12.45 mm)
(b) gasoline
exhaust .... 0.452 to 0.482 in. (11.48 to 12.24 mm)
intake .... 0.460 to 0.490 in. (11.68 to 12.45 mm)

BASIC ENGINE

SPECIFICATIONS AND TORQUE VALUES—Continued

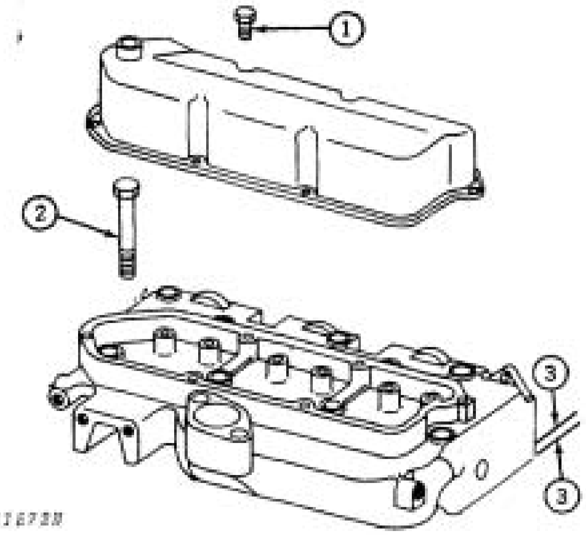


Fig. 10-Rocker Arm Cover and Cylinder Head

1 - Rocker arm cover to cylinder head cap screw torque (diesel and gasoline) .... 25 lb-in (0.288 kg-m)

2 - Cylinder head to block cap screw torque (diesel and gasoline) (dip cap screws in oil) .... 95 lb-ft (13.1 kg-m) after 30 minutes run at 3/4 to full load loosen bolts 5 to 10 degrees, retighten one at a time to 95 lb-ft (13.1 kg-m)

3 - Maximum amount of material to be removed from bottom of head (diesel and gasoline) .... 0.030 in. (0.762 mm)

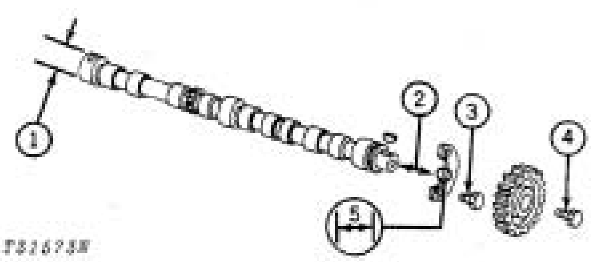


Fig. 11-Camshaft, Bushing and Gear

1 - Outside diameter of camshaft journal (diesel and gasoline) .... 2.1997 to 2.2007 in. (55.872 to 55.898 mm)

Camshaft journal to bushing clearance (diesel and gasoline) .... 0.0035 to 0.0055 in. (0.089 to 0.140 mm)

Maximum allowable clearance (diesel and gasoline).... 0.0090 in. (0.229 mm)

2 - Camshaft end play (diesel and gasoline)......... 0.0025 to 0.0085 (0.064 to 0.216 mm)

Maximum allowable end play (diesel and gasoline).... 0.0150 in. (0.381 mm)

3 - Camshaft thrust plate to block cap screw torque (diesel and gasoline) .... 35 lb-ft (4.8 kg-m)

4 - Camshaft gear to camshaft cap screw torque (diesel and gasoline)....... 85 lb-ft (11.8 kg-m)

5 - Thrust plate thickness (diesel and gasoline)...... 0.1560 to 0.1580 in. (3.962 to 4.013 mm)

Minimum allowable thickness (diesel and gasoline)..... 0.1510 in. (2.82 mm)

BASIC ENGINE

SPECIFICATIONS AND TORQUE VALUES—Continued

Fig. 12-Connecting Rod

1 - Inside diameter of piston pin bushing in rod
(a) diesel .... 1.3760 to 1.3770 in. (34.950 to 34.976 mm)
(b) gasoline .... 1.3760 to 1.3770 in. (34.950 to 34.976 mm)
Piston pin to connecting rod bushing clearance
(a) diesel .... 0.0008 to 0.0022 in. (0.020 to 0.056 mm)
(b) gasoline .... 0.0007 to 0.0021 in. (0.0178 to 0.053 mm)

2 - Connecting rod bearing inside diameter (assembled) (diesel and gasoline) .... 2.7502 to 2.7520 in. (68.855 to 69.901 mm)
Connecting rod bearing to crankshaft journal clearance (diesel and gasoline) .... 0.0012 to 0.0040 in. (0.030 to 0.102 mm)
Maximum clearance .... 0.006 in. (0.15 mm)
Connecting rod undersize bearing inserts available (diesel and gasoline) .... 0.002, 0.010, 0.020 and 0.030 (0.05, 0.25, 0.51, and 0.76 mm)
Connecting rod bearing bore I.D. .... 2.9000 to 2.9010 in. (73.660 to 73.685 mm)

3 - Connecting rod cap to rod cap screw torque
(a) diesel (dip cap screws in oil) .... 60 to 70 lb-ft (8.3 to 9.7 kg-m)
(b) gasoline (dip cap screws in oil) .... 40 to 46 lb-ft (5.5 to 6.2 kg-m)

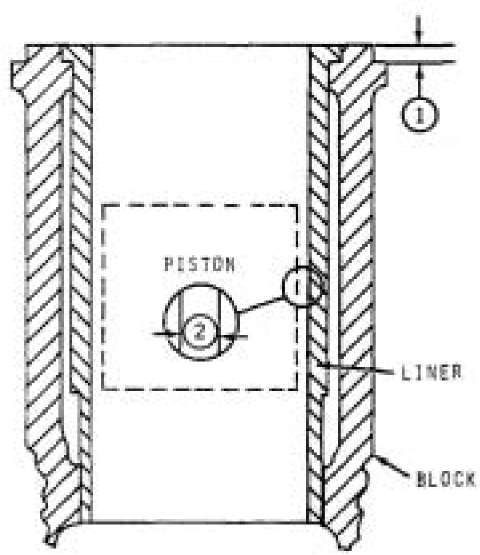


Fig. 13-Liner, Piston and Block

1 - Liner height above block (diesel and gasoline) .... 0.001 to 0.004 in. (0.03 to 0.10 mm)

2 - Piston to cylinder liner clearance at bottom of skirt (maximum) (diesel and gasoline) .... 0.0080 in. (0.20 mm)
Liner out-of-roundness (maximum) (diesel and gasoline) .... 0.0020 in. (0.05 mm)
Liner taper (maximum) (diesel and gasoline) .... 0.0020 in. (0.05 mm)

BASIC ENGINE

SPECIFICATIONS AND TORQUE VALUES—Continued

Piston cooling orifice in main bearing web torque
(diesel) . . . . .85 to 110 lb-in.
(0.98 to 1.27 kg-m)

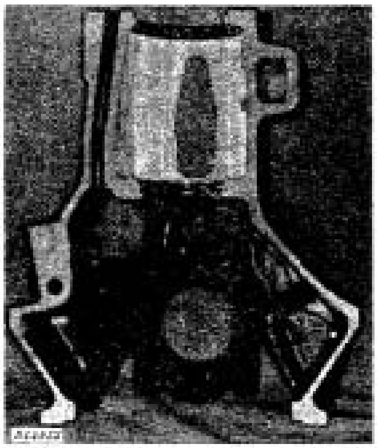


Fig. 14-Piston Cooling Orifice

BASIC ENGINE

SPECIFICATIONS AND TORQUE VALUES—Continued

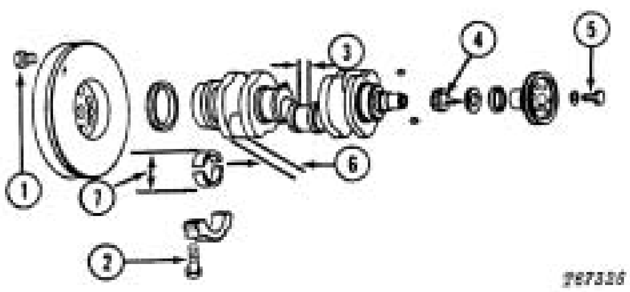


Fig. 15-Crankshaft Assembly

1 - Flywheel to crankshaft cap screw torque
("D" Grade) .... 85 lb-ft (11.8 kg-m)
("F" Grade) .... 120 lb-ft (17 kg-m)

2 - Main bearing caps to block cap screw torque
(cap screw oiled) .... 85 lb-ft (11.8 kg-m)
Flywheel housing cap screw torque .... 35 lb-ft (5 kg-m)

3 - Main bearing journal diameter (diesel and gasoline) .... 3.1230 to 3.1240 in. (79.324 to 79.350 mm)
Round within .... 0.0030 in. (0.076 mm)

4 - Crankshaft end play (diesel and gasoline) .... 0.0020 to 0.0080 in. (0.051 to 0.203 mm)
Maximum allowable end play (diesel and gasoline) .... 0.015 in. (0.38 mm)

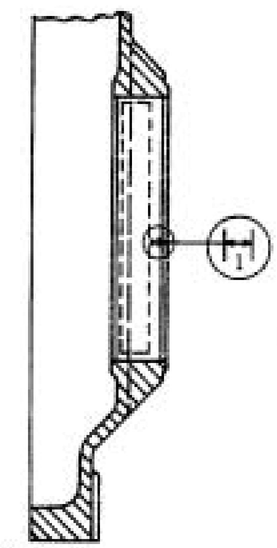
5 - Fan pulley to crankshaft cap screw torque (diesel and gasoline) .... 85 lb-ft (11.8 kg-m)

6 - Connecting rod journal diameter
(a) diesel .... 2.7480 to 2.7490 in. (69.80 to 69.82 mm)
Round within (diesel and gasoline) .... 0.0030 in. (0.076 mm)
(b) gasoline .... 2.3085 to 2.3095 in. (58.636 to 58.661 mm)

7 - Main bearing inside diameter (assembled) (diesel and gasoline) ...... 3.1256 to 3.1276 in. (79.390 to 79.441 mm)
Main bearing to journal clearance (diesel and gasoline) .... 0.0016 to 0.0046 in. (0.041 to 0.117 mm)
Maximum allowable clearance (diesel and gasoline) .... 0.0060 in. (0.152 mm)
Main bearing bore I.D. ..... 3.3250 to 3.3260 in. (84.455 to 84.480 mm)
Journal taper per inch of journal length (diesel and gasoline) .... 0.0010 in. (0.025 mm)
Journal out-of-roundness (diesel and gasoline) .... 0.0030 in. (0.076 mm)
Main bearing undersize inserts available (diesel and gasoline) .... 0.002, 0.010, 0.020, and 0.030 in. (0.05, 0.25, 0.50, and 0.76 mm)

BASIC ENGINE

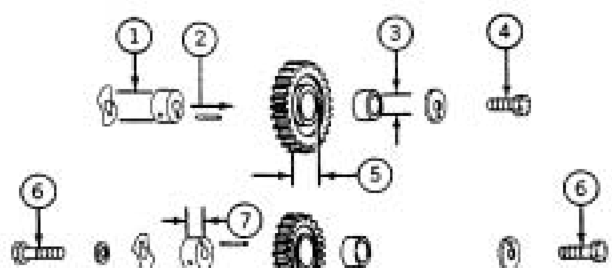
SPECIFICATIONS AND TORQUE VALUES—Continued



T87591N

Fig. 16-Front Oil Seal Installed in Timing Gear Cover

1 - Distance of front oil seal from front of timing gear cover (diesel and gasoline) .... 0.33 in. (8.3 mm)



T31576N

Fig. 17-Upper and Lower Idler Gears

1 - Upper and lower idler shaft outside diameter (diesel and gasoline)...... 1.7495 to 1.7505 in. (44.437 to 44.463 mm)

2 - Upper and lower idler shaft end play (diesel and gasoline) .... 0.0010 to 0.0070 in. (0.025 to 0.178 mm)

3 - Upper and lower idler bushing inside diameter (diesel and gasoline)...... 1.7520 to 1.7530 in. (44.501 to 44.526 mm)

Oil clearance between shaft and bushing (diesel and gasoline)...... 0.0015 to 0.0035 in. (0.038 to 0.089 mm)

Maximum oil clearance (diesel and gasoline)................0.0060 in. (0.152 mm)

4 - Crankshaft upper idler gear cap screw torque (diesel and gasoline).................. 65 lb-ft (9 kg-m)

5 - Width of upper and lower idler gear at hub (diesel and gasoline)...... 0.8650 to 0.8670 in. (21.971 to 22.022 mm)

6 - Crankshaft lower idler gear cap screw torque (diesel and gasoline).................. 95 lb-ft (13.1 kg-m)

7 - Width of upper and lower idler gear shaft (diesel and gasoline)...... 0.8680 to 0.8720 in. (22.047 to 22.149 mm)

BASIC ENGINE

SPECIFICATIONS AND TORQUE VALUES—Continued

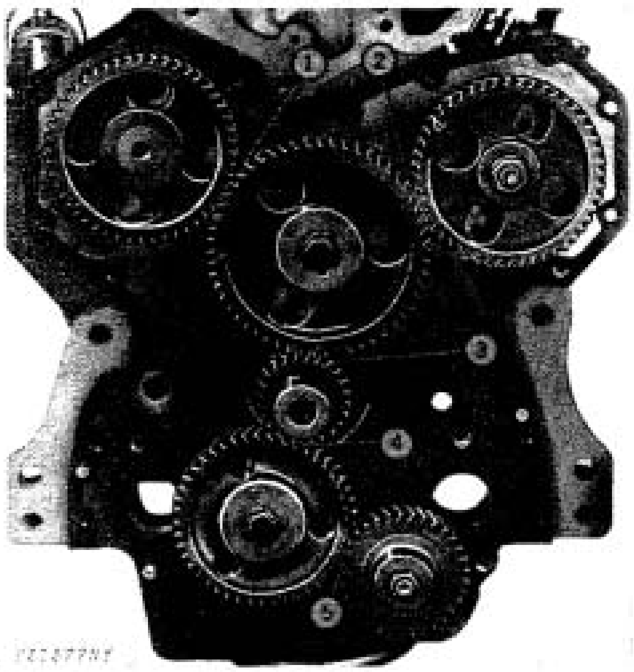


Fig. 18-Diesel Gear Train Backlash

1 - Camshaft gear to upper idler gear .... 0.0027 to 0.0116 in. (0.069 to 0.295 mm)

2 - Injection pump gear to upper idler gear .... 0.0028 to 0.0135 in. (0.071 to 0.343 mm)

3 - Crankshaft gear to upper idler gear .... 0.0027 to 0.0116 in. (0.069 to 0.295 mm)

4 - Crankshaft gear to lower idler gear .... 0.0027 to 0.0137 in. (0.069 to 0.348 mm)

5 - Oil pump gear to oil pump gear .... 0.0016 to 0.0147 in. (0.041 to 0.373 mm)

Gasoline Gear Train Backlash (Not Illustrated)

Camshaft gear to upper idler gear .... 0.0028 to 0.0135 in. (0.071 to 0.343 mm)

Governor gear to upper idler gear .... 0.0023 to 0.0127 in. (0.083 to 0.323 mm)

Crankshaft gear to upper idler gear .... 0.0027 to 0.0116 in. (0.069 to 0.297 mm)

Crankshaft gear to lower idler gear .... 0.0027 to 0.0137 in. (0.069 to 0.348 mm)

Oil pump gear to lower idler gear .... 0.0016 to 0.0147 in. (0.041 to 0.373 mm)

Camshaft gear to distributor gear .... 0.0005 to 0.0075 in. (0.013 to 0.191 mm)

BASIC ENGINE

SPECIFICATIONS AND TORQUE VALUES—Continued

ENGINE BREAK-IN

NOTE: Whenever possible, use a dynamometer to provide a more accurate break-in, assuring proper initial seating of new piston rings.

Time	Load*	Engine Speed	Remarks
5 Minutes	No Load	800 rpm (Slow Idle)	Check oil
5 Minutes	No Load	1500 to 2000 rpm (1/2 Throttle)	pressure,
5 Minutes	1/4 Load	1900 to 2200 rpm	coolant
10 Minutes	1/2 Load	(3/4 Throttle)	temperature,
10 Minutes	1/2 to 3/4 Load	(use PTO stop	and leakage.
10 Minutes**	3/4 to Full Load	position if	
100 Hours+	All Loads	so equipped)	Field Only

**Loads can be simulated in the field by controlled machine operation.*

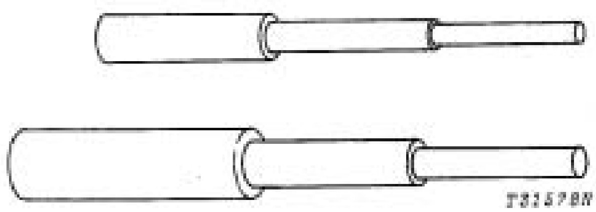
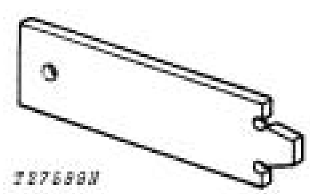
***After this run, loosen cylinder head bolts 5 to 10 degrees; then retighten bolts one at a time, in sequence, to 110 lb-ft (15.2 kg-m). Check and reset valve clearance. Loosen intake and exhaust manifold bolts (gasoline engines); then retighten to 35 lb-ft (4.8 kg-m).*

+After break-in, drain crankcase oil, and remove filter. Install new filter and fill crankcase with oil of proper viscosity and service classification.

BASIC ENGINE

SPECIAL TOOLS

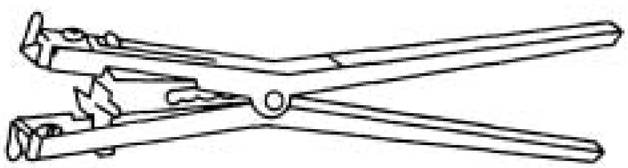
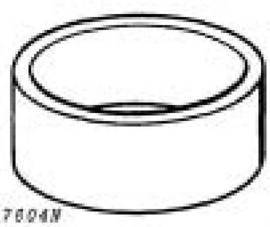
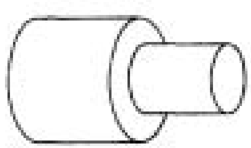
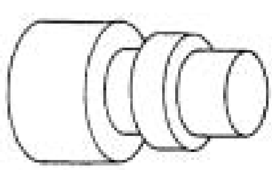
Essential Tools

Tool	Tool Number	Use
 T31578N Fig. 19-Mandrels	JDE-7	Mandrels - Used with bushing and seal drivers.
 T59818N Fig. 20-Knurling Tool	D20002WI	Knurling Tool - To knurl engine valve guides.
 T27559N Fig. 21-Keystone Ring Groove Wear Gauge	JDE-62	Ring Groove Wear Gauge - To measure keystone ring groove wear.

BASIC ENGINE

SPECIAL TOOLS—Continued

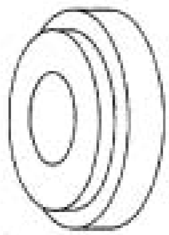
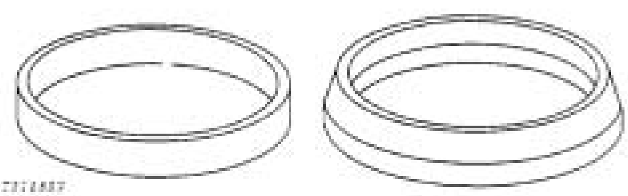
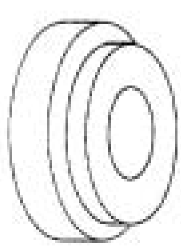
Essential Tools—Continued

Tool	Tool No.	Use
 Fig. 22-Piston Ring Expander	JDE-135	Universal Ring Expander - To install piston rings
	JDE-45	Limiting Piston Ring Expander - To install piston rings
 T27604N *Fig. 23-Ring Compressor*	JD271	Piston Ring Compressor - To compress piston rings when installing pistons.
 T31579N *Fig. 24-Driver*	JD246	Governor Bushing Driver - To install governor bushings.
 T31580N *Fig. 25-Driver*	JD248-A	Oil Pressure Regulating Valve Bushing Driver - To install oil pressure regulating valve bushing.

BASIC ENGINE

SPECIAL TOOLS—Continued

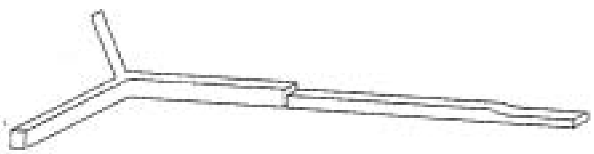
Essential Tools—Continued

Tool	Tool No.	Use
 T31583N *Fig. 26-Driver*	JD250	Crankshaft Front Oil Seal Driver - To install crankshaft front oil seal.
 T46843N *Fig. 27-Driver*	JD297-1	Crankshaft Rear Oil Seal Driver - To install crankshaft rear oil seal. Use with JD297-2.
 T31585N *Fig. 28-Driver*	JD297	Crankshaft Rear Oil Seal Installation Set - Includes JD297-2 Pilot Ring and JD251-4 Seal Protector, used with JD297-1 to install crankshaft rear oil seal.
 T31584N *Fig. 29-Driver*	JD252	Idler Gear Bushing Driver - To install idler gear bushing.

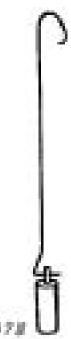
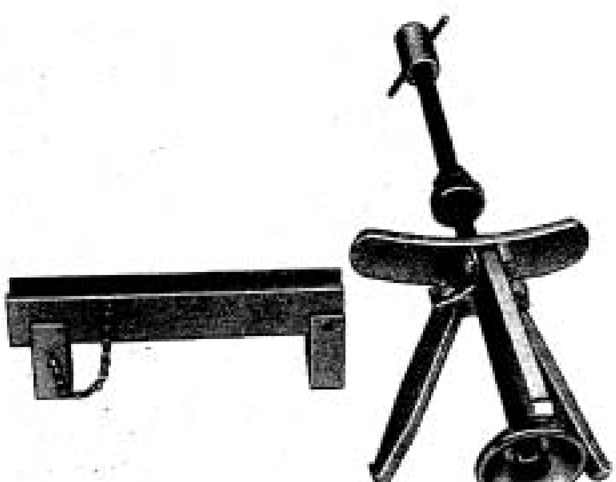
BASIC ENGINE

SPECIAL TOOLS—Continued

Essential Tools—Continued

Tool	Tool No.	Use
 Fig. 30-Gear Timing Tool	JD254	Gear Timing Tool - To time gear train.

Convenience Tools

Tool	Tool No.	Use
 Fig. 31-Magnetic Holding Tool	D-15001NU	Magnetic Tool - To hold cam followers.
 Fig. 32-Cylinder Liner Puller	D01062AA or D01073AA	Cylinder Liner Puller - To remove cylinder liners.

ENGINE LUBRICATION SYSTEM

SPECIFICATIONS AND TORQUE VALUES

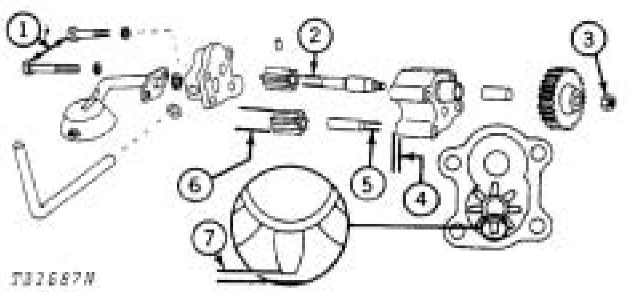


Fig. 33-Engine Oil Pump Assembly

1 - Oil pump to block cap screw torque (diesel and gasoline) .... 35 lb-ft (4.8 kg-m)

2 - Outside diameter of drive gear shaft (diesel and gasoline) .... 0.6308 to 0.6312 in. (16.022 to 16.032 mm)

3 - Oil pump gear to drive shaft nut torque (diesel and gasoline)............. 35 to 45 lb-ft (4.8 to 6.2 kg-m)

4 - Pump gears to cover clearance (diesel and gasoline) .... 0.0012 to 0.0062 in. (0.031 to 0.158)

5 - Outside diameter of idler shaft (diesel and gasoline) .... 0.4850 to 0.4856 in. (12.319 to 12.334 mm)

6 - Oil pump gear width (diesel and gasoline) .... 1.6203 to 1.6223 in. (41.156 to 41.206 mm)

7 - Pump gears-to-housing radial clearance (diesel and gasoline) .... 0.0030 to 0.0040 in. (0.076 to 0.102 mm)

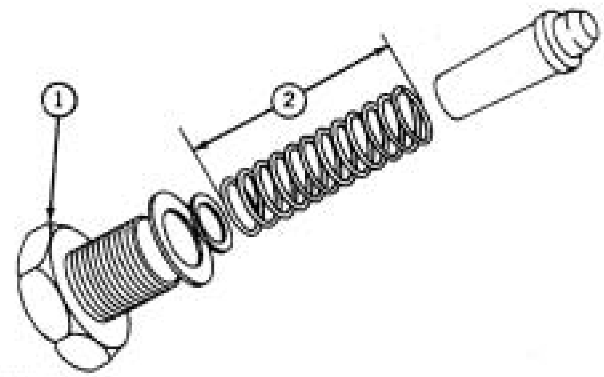


Fig. 34-Oil Pressure Regulating Valve

1 - Oil pressure regulating valve plug torque (diesel and gasoline).................... 70 lb-ft (9.7 kg-m)

2 - Oil pressure regulating valve spring compressed at 15 ± 5 lb. (6.8 ± 0.45 kg) ....1.68 in. (42.7 mm)

ENGINE LUBRICATION SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

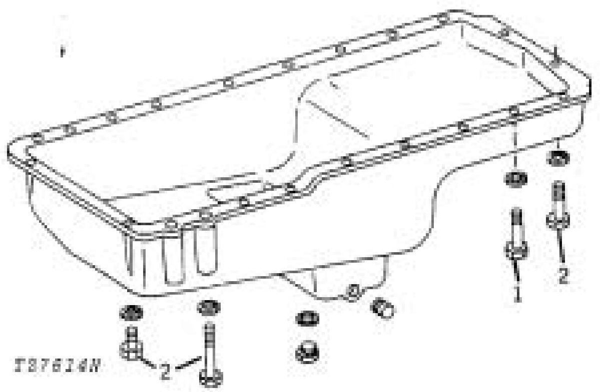


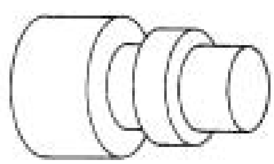
Fig. 35-Oil Pan

1 - Oil pan to block 1/2 inch cap screw torque (diesel and gasoline) ....85 lb-ft (11.8 kg-m)

2 - Oil pan to block 3/8 inch cap screw torque (diesel and gasoline) ....35 lb-ft 4.8 kg-m)

SPECIAL TOOLS

Essential Tools

Tool	Tool Number	Use
 *Fig. 36-Driver*	JD-248-A	Oil Pressure Regulating Valve Bushing Driver - To install pressure regulating valve bushing.

ENGINE COOLING SYSTEM

SPECIFICATIONS AND TORQUE VALUES

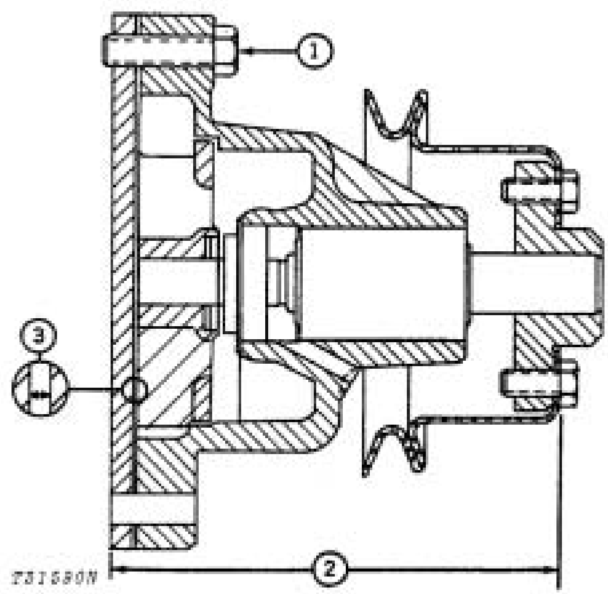


Fig. 37-Water Pump

Radiator test pressure
(diesel and gasoline) .... 10 psi (.70 kg/cm²)

Radiator cap test pressure
(diesel and gasoline) .... 6.25 to 7.50 psi
(.44 to .53 kg/cm²)

Thermostat range
Gasoline .... 180°F (82.2°C)
Diesel .... 180°F (82.2°C)

1 - Water pump rear cover cap screw torque
(diesel and gasoline)................... 35 lb-ft
(4.8 kg-m)

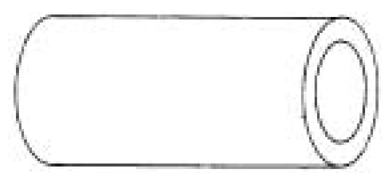
2 - Fan surface on pulley-to-rear of water pump
housing (diesel and gasoline) .... 5.71 in.
(145.03 mm)

3 - Water pump impeller flush to housing
within 0.10 in. .... (0.25 mm)

ENGINE COOLING SYSTEM

SPECIAL TOOLS

Convenience Tools

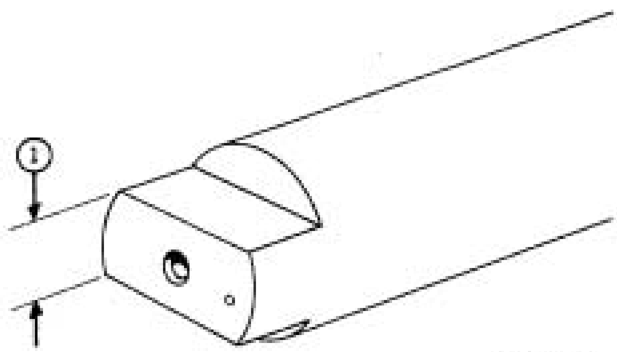
Tool	Tool Number	Use
	JD-262-A	Water Pump Bearing Installation Tool - To install water pump bearing.

T81581N

Fig. 38-Bearing Installation Tool

FUEL SYSTEM

SPECIFICATIONS AND TORQUE VALUES

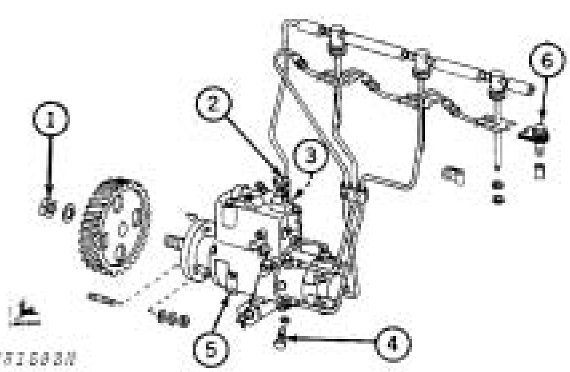


T81582N

Fig. 39-Injection Pump Drive Shaft Tang Thickness

Fuel tank capacity .... 19.5 gal. (73.815 L)

1 - Fuel injection pump drive shaft tang thickness (Minimum) .... 0.305 in. (7.747 mm)



T81583N

Fig. 40-Injection Pump and Nozzles

1 - Drive shaft hex. nut torque .... 45 lb-ft (6.2 kg-m)

2 - Fuel inlet screw torque .... 20 lb-ft (2.8 kg-m)

3 - Throttle control lock screw torque .... 35 to 40 lb-in (0.430 to 0.450 kg-m)

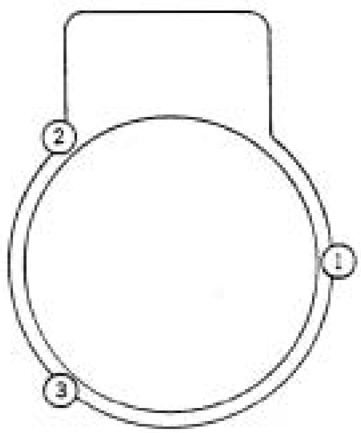
4 - Injection line connector screw torque ... 35 lb-ft (4.8 kg-m)

5 - Timing hole cover screw torque .. 15 to 20 lb-in (0.173 to 0.23 kg-m)

6 - Injection nozzle hold down cap screw torque .... 20 lb-ft (2.8 kg-m)

FUEL SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued



T55880N

Fig. 41-Delivery Sequence

IMPORTANT: In order to obtain proper test results, do the following:

Use 0.25 in. (6.4 mm) O.D. by 0.093 in. (2.36 mm) I.D. by 20 in. (508 mm) long test lines.

Use 12SD12 Robert Bosch Calibrating Nozzles, 2500 psi (172 bar) (176 kg/cm²) opening pressure. Use JDF-2 Test Oil, or a test oil equivalent to SAE J967A with a 34 to 36 SUS rating with oil at 100°F (38°C).

Test oil should be 110° to 115°F (43° to 46°C).

NOTE: 1 to 3 psi (0.07 to 0.21 bar) (0.07 to 0.21 kg/cm²) supply pressure required at pump inlet.

Operate pump clockwise (viewed from drive end) at 500 rpm wide open throttle (WOT) for 10 minutes prior to test.

Electric shut-off connected to 12-volt D.C. negative (−) ground power source.

FUEL SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued (JDB331MD2406-AR49904)

Transfer pump vacuum (200 rpm)
(minimum) . . . . 18 in. Hg.
(609.5 mbar)

Transfer pump pressure (1250 rpm) . . . . 85 to 95 psi
(5.9 to 6.5 bar) (6.0 to 6.7 kg/cm²)

Automatic speed advance

RPM	Cam Movement
325 to 525	1°
750 to 850	5°
by 1275	8° minimum

Minimum cranking speed
delivery (75 rpm)
Volume . . . . 40 cm³/1000 strokes
Transfer pump pressure
(minimum) . . . . 12 psi
(1 bar) (1 kg/cm²)

Fuel delivery (1250 rpm)
Volume . . . . 63 to 66 cm³/1000 strokes
Maximum variation
between cylinders . . . . 3 cm³/1000 strokes

Fuel delivery (750 rpm)
Volume . . . . 64 to 68 cm³/1000 strokes
Maximum variation
between cylinders . . . . 5 cm³/1000 strokes

High idle (WOT) (1340 rpm)
Volume . . . . 10 to 12 cm³/1000 strokes
Maximum variation
between cylinders . . . . 4 cm³/1000 strokes

Governor cut-off (1365 rpm)
Volume . . . . 5 cm³ max/1000 strokes

Low idle (400 rpm)
Volume . . . . 10 to 12 cm³/1000 strokes
Maximum variation
between cylinders . . . . 4 cm³/1000 strokes

Check shut-off at (200 rpm)
Volume . . . . 2 cm³ max/1000 strokes

FUEL SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

Fuel Injection Nozzles

General Information

Number of orifices 4
Orifice diameter .... 0.011 in. (0.28 mm)
Sac hole diameter .... 0.042 in. (1.07 mm)
Hole length (sac wall) .... 0.021 in. (0.53 mm)

Nozzle Settings

Nozzle opening pressure (new) .... 3150 to 3250 psi (217 to 224 bar) (221 to 228 kg/cm²)

Nozzle opening pressure (used) .... 2950 to 3050 psi (203 to 210 bar) (207 to 214 kg/cm²)

Maximum opening pressure difference between cylinders .... 100 psi (7 bar) (7 kg/cm²)

Nozzle valve lift .... 1/2 turn from bottom (0.009 in. [0.23 mm] nominal)

Pressure adjusting screw-to-nozzle body torque .... 70 to 80 lb-in (7.9 to 9.0 Nm) (0.8 to 0.9 kg/m)

Lift adjusting lock nut torque .... 35 to 45 lb-in (4.0 to 5.1 Nm) (0.40 to 0.52 kg/m)

Return oil leakage (used) .... 3 to 10 drops per 30 seconds at 1500 psi (103 bar) (105 kg/cm²) after first drop

FUEL SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

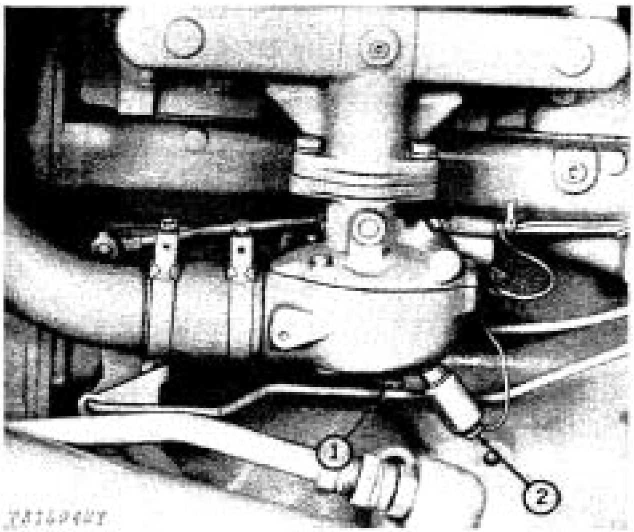


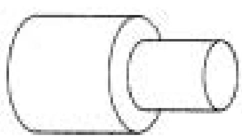
Fig. 42-Initial Carburetor Adjustments

1 - Idle needle—turn in to seat and back out one turn.

2 - Load adjusting screw—turn in to seat and back out approximately 2 turns.

SPECIAL TOOLS

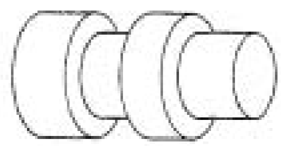
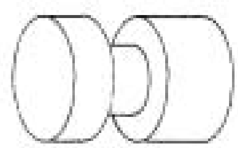
Essential Tools

Tool	Tool Number	Use
	13369 (Not Illustrated)	Installation Tool - To install injection pump drive shaft seal.
 T81696NY Fig. 43-Bearing Removal Tool	M-504	Bearing Removal Tool - To remove throttle shaft bearing in carburetor.
 T81696N Fig. 44-Driver	JD-240	Governor Bushing Driver - To install gasoline governor bushing.

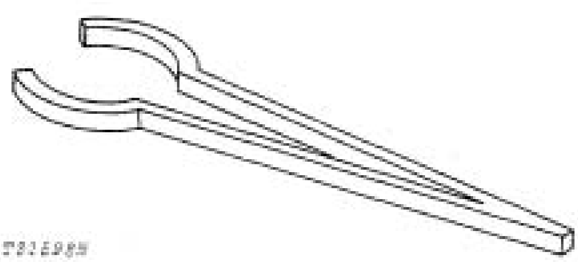
FUEL SYSTEM

SPECIAL TOOLS—Continued

Essential Tools—Cont.

Tool	Tool Number	Use
 T81667N Fig. 45-Driver	JD241	Governor Bushing Driver - To install gasoline governor bushing.
 T81598N Fig. 46-Driver	JD-245	Governor Bushing Driver - To install gasoline governor bushing.

Convenience Tool

Tool	Tool Number	Use
 T81598N Fig. 47-Drive Shaft Installation Tool	JD-256	Injection Pump Drive Shaft Seal Installation Tool - To install drive shaft seal.
	M-8 (Not illustrated)	Float Bending Tool - To bend carburetor float to correct height.

SPEED CONTROL LINKAGE

SPECIFICATIONS AND TORQUE VALUES

See Group 35, Section 70 for Speed Control Linkage Specifications and Special Tools.

Section 30
ELECTRICAL SYSTEM

CONTENTS OF THIS SECTION

Group 5
BATTERIES

GENERAL INFORMATION

1—Ground Cables
2—Positive Cable
3—Battery Clamp
4—L.H. Cowl Panel

Fig. 1-Battery Connections

Batteries are located directly in front of the dash assembly. To gain access to the batteries, swing open the cowl door.

When replacing a battery, use the John Deere battery or its equivalent shown in the following chart:

John Deere Part Number	AR67338
Volts	12
BCI Group	24
Cold Cranking Amps	
0°F. [-17.8°C.]	370
(-20°F.) [-28.9°C.]	300
Reserve Capacity	
(minutes at 25 amps)	106

There are two important things that must be done periodically in order to obtain long life from a battery.

First, the electrolyte must at all times be kept above the plates and separators. The electrolyte level should be checked once a week, or after fifty hours of operation. See "Checking Electrolyte Level" in this group.

Second, be sure the battery is kept nearly charged at all times. The state of charge should be checked at frequent intervals by making specific gravity readings with a battery hydrometer. See "Specific Gravity Cell Comparison Test" in this group.

FOS

For additional information on batteries, refer to "Storage Batteries" in FOS Manual-ELECTRICAL SYSTEM.

Precautions

CAUTION: All exposed metal surfaces on batteries are "alive." Never lay a metal object on top of a battery as a short circuit may result. Sparks or an open flame must be kept away from batteries due to the presence of explosive gas in and around the batteries while they are being charged or in use.

BATTERY ACID IS HARMFUL ON CONTACT with the skin or materials. If acid spills, here are some first aid tips to minimize the damage:

1. Remove immediately any clothing on which acid spills.

2. If acid contacts the skin, rinse the affected area with running water for 10 to 15 minutes.

3. If acid ever splashes into the eyes, force the lids open and flood the eyes with running water for 10 to 15 minutes. Then see a doctor at once. Don't use any medication or eye drops unless prescribed by the doctor.

4. To neutralize acid spilled on the floor, use one of the following mixtures:

a. One pound (454 g) of baking soda in a gallon (4 l) of water.

b. One pint (474 ml) of household ammonia in a gallon (4 l) of water.

5. Acid from the batteries can also damage the paint and metal surfaces of the machine. Avoid overfilling the battery cells and protect the battery when necessary.

REMOVAL

Remove batteries as follows:

1. Open cowl door and remove left-hand cowl panel (4, Fig. 1).

2. Note carefully the location of the positive (+) terminals so that the batteries are installed in the same way.

3. Disconnect the ground cables (1) first. Use only a box end wrench to loosen clamps on terminals. Remove clamps using a screw-type puller. DO NOT hammer on the battery posts.

4. Remove the positive connector cable and positive cable (2).

5. Remove the battery clamp (3) and remove batteries.

6. Check cables for worn or frayed insulation. Replace cable clamps or bolts if corroded.

INSPECTION

Cleaning Batteries

Wipe batteries with a damp cloth. If terminals are corroded, use a stiff brush and wash with an ammonia solution or a solution of baking soda (1/4 pound added to a quart of water). Keep vent plugs tight while washing. After washing, flush battery and compartment with clear water. Then coat terminals with petroleum jelly to protect against corrosion. Be sure vent holes in vent plugs are open.

Checking Electrolyte Level

Check electrolyte level in each cell. Proper level is to bottom of filler neck. Always add distilled water if available. If not, use clean soft water. Avoid hard water.

NEVER ADD ACID to the battery unless electrolyte is lost by spilling.

Always wait until after checking specific gravity before you add water to the battery. This will assure a true reading. If level is too low to check specific gravity, add water, operate engine for a few minutes to let water and electrolyte mix, then check.

In freezing weather, never add water to the battery unless it will be operated immediately to allow proper mixing of water with electrolyte.

TESTING

Testing the battery will tell you whether the battery is usable, requires recharging or should be replaced. Regular periodic testing provides a means of anticipating battery failure.

Specific Gravity Cell Comparison Test

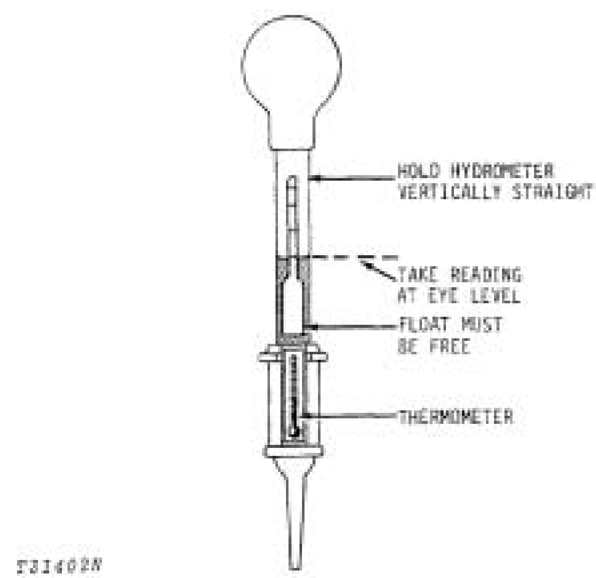


Fig. 2-Checking Specific Gravity

Check the specific gravity of each cell with an accurate hydrometer equipped with a thermometer. Hold the hydrometer vertically and take the reading at eye level.

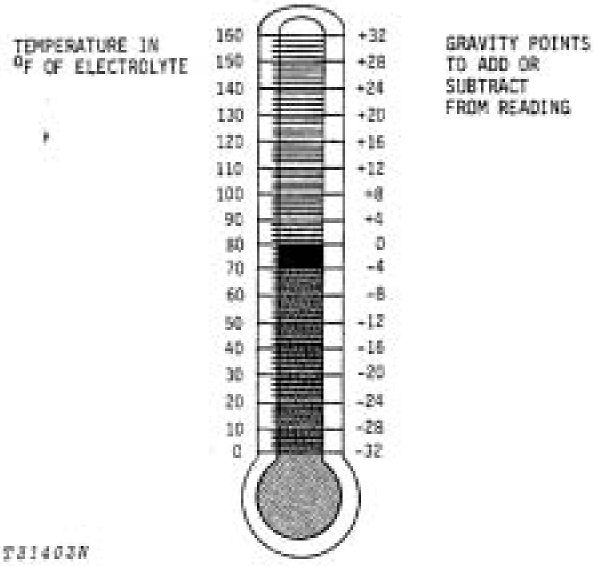


Fig. 3-Electrolyte Temperature Correction Table

True readings are taken at 80°F [26.7°C] only. To correct a reading, add four gravity points (0.004) for every 10°F [−12.2°C] that the electrolyte temperature is above 80°F [26.7°C]. Subtract four gravity points (0.004) for every 10°F [−12.2°C] that the electrolyte is below 80°F [26.7°C]. A hydrometer reading of 1.260 at 0°F [−17.8°C] is corrected to 1.228.

Specific gravity should read from 1.215 to 1.270 (corrected for 80°F [26.7°C] electrolyte temperature).

The variation in readings between cells should be no more than 50 specific gravity points (0.050).

If specific gravity readings show a difference between the highest and lowest cell of more than 50 specific gravity points (0.050) or more, the battery is defective and must be replaced.

If the maximum difference between all readings is less than 50 specific gravity points (0.050) and the lowest cell reading is 1.200 or above, the battery is in good condition and may be returned to service.

If the maximum difference between all readings is less than 50 specific gravity points (0.050) but the lowest cell reading is below 1.200, the battery is good but needs to be charged by the slow method.

Specific Gravity Reading (Adjusted)	State of Charge
1.260	100%
1.230	75%
1.200	50%
1.170	25%
1.140	Very Little Useful Capacity
1.110	Discharged

The table above shows the state of charge of a typical battery at various specific gravity readings.

High-Rate Discharge Test

If using D-24001 MO battery tester, follow instructions supplied with tester.

To be sure of a battery's ability to deliver current under load, give it a high-rate discharge test. This test shows the internal conditions that might not otherwise be detected.

The following conditions must exist before this test is made:

1. Battery specific gravity must not be less than 1.215 at 80°F (26.7°C). Otherwise, erratic or unreliable readings will result.

2. Battery electrolyte temperature must be between 70°F (21.1°C) and 90°F (32.2°C).

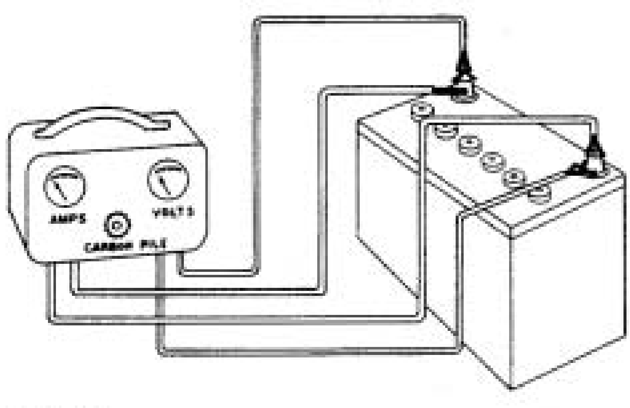


Fig. 4-High-Rate Discharge Battery Tester Connected to Battery

Connect the high-rate discharge tester to the battery and be sure to follow the manufacturer's instructions (Fig. 4).

The terminal voltage reading should remain above 9.0 volts.

If the terminal voltage falls below 9.0 volts, the battery is defective or it is not as fully charged as the specific gravity reading indicates in the specific gravity test.

To be sure of the battery condition, carefully charge it and repeat the test.

Remember these key facts when testing batteries.

1. In general, if all cells of a battery test the same, the battery is good. If all are low, the battery usually only needs recharging.

2. If there is a real difference between cells, the battery generally must be replaced.

FOS For additional information on Battery Testing" refer to "Storage Batteries" in FOS Manual - ELECTRICAL SYSTEMS.

CHARGING THE BATTERY

Batteries can be recharged in two ways:

1. Fast charging.
2. Slow charging.

A battery that is in satisfactory condition but requires recharging will accept a large amount of charging current without undesirable effect. This type of battery may be charged quickly at a high rate with a battery fast charger.

A battery that becomes sulfated, however, will not accept a high rate of charging current without possible damage. Its sulfated condition provides increased resistance to current flow within the battery. Flow of a high rate of charging creates heat, which can result in warping of the plates, boiling of electrolyte, and eventual damage to the separators. Cell caps and covers and the battery case may be damaged or distorted.

A battery in this condition must be charged over a long period at a low rate. In this manner, sulfate formation on the plates will be gradually broken down and the battery returned to its normal charged state.

NOTE: When charging batteries be sure to follow the manufacturer's instructions for using the charger.

FOS For additional information on charging batteries, refer to "Storage Batteries" in FOS Manual - ELECTRICAL SYSTEM.

John Deere battery chargers can be used as a booster to start the engine.

IMPORTANT: A battery charger should not be used as a booster if a battery has a very low charge (1.150 specific gravity reading or lower). A low charged battery greatly increases the possibility of mistakenly connecting the charger to the battery in reverse, and it is possible to reverse the charge on a battery. If this is done the alternator diodes or the wire harness may be damaged.

If the battery has specific gravity reading of 1.150 or lower, disconnect battery cables and charge it until the specific gravity reading is 1.150 or above before using a battery charger as a booster.

INSTALLATION

Install batteries as follows:

1. Be sure the batteries are fully charged.

2. Set batteries in tray making sure batteries are resting level.

3. Tighten the battery clamp nuts evenly until batteries are secure. Do not overtighten as this will distort or crack the battery case.

4. Clean the battery terminals and cable clamps with a wire brush before attaching the clamps. This will assure a good contact.

5. Check for correct polarity of the battery. Connect the positive cable first. Before connecting the ground cable, momentarily touch it against the battery post. With all switches and accessories off, no spark should occur. If spark does occur, do not connect the ground cable. Check for reversed battery polarity, improper alternator connection, defective electrical wire connection, or defective electrical equipment.

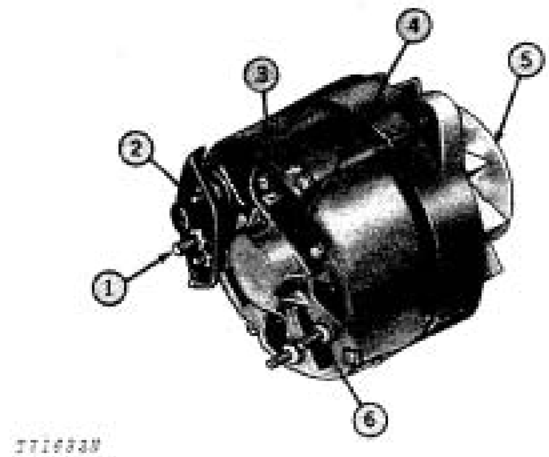
6. Tighten the clamps on the battery terminals. Use a box-end wrench carefully to avoid twisting the battery terminal posts.

7. Coat the terminals with petroleum jelly to prevent corrosion. Never paint the terminal posts.

8. Install left-hand cowl panel.

Group 10
CHARGING SYSTEM

GENERAL INFORMATION



1—Output Terminal
2—Regulator Terminal
3—Field Terminal
4—Brush and Holder Cover
5—Pulley
6—Ground Terminal

Fig. 1-Alternator

The alternator is an open type with an isolation diode.

It is not necessary to disassemble the alternator to replace brushes. The brushes can be replaced with the alternator left intact on the engine.

The alternator is cooled by an externally mounted fan. Correct air circulation requires air to be pulled into the rear of the alternator and expelled through the front housing.

Alternator can be divided into three main assemblies:

1. Rotor Assembly - magnetic field which rotates.

2. Stator Assembly - conductors which are stationary.

3. Rectifier Assembly - diodes which change a.c. to d.c. current.

The rotor assembly consists of a wire coil wrapped around an iron core and mounted on a rotating shaft. The coil is enclosed between two interlocking soft iron sections. The ends of the coil are connected to two slip rings mounted on one end of the shaft.

Small brushes ride on the slip rings. One of the brushes is connected to ground. The other is insulated and connects to the alternator field terminal. This terminal is connected through the regulator and the key switch to the battery.

The rotor turns on sealed ball bearings that contain lubrication for the life of the bearing.

The stator assembly is a laminated soft iron ring with three groups of coils or windings in the slots. Each group is made up of from eight to sixteen coils, depending on the design.

One end of each stator winding is connected to a positive and negative diode. The other ends of the stator windings are wye connected.

To convert the a.c. to d.c. current, diodes are used. Six diodes are mounted at the slip ring end of the alternator housing. Three negative diodes are mounted in a heat sink bolted to the end frame. Three positive diodes are mounted in the heat sink which is insulated from the end frame.

The isolation diodes primary function is to act as an automatic switch between the battery and alternator. It will block any current flow from the battery back to the alternator and regulator when the alternator is not operating.

FOS D — For additional information on alternators, refer to "Charging Circuits" in FOS Manual - ELECTRICAL SYSTEMS.

REMOVAL

CAUTION: Disconnect the battery ground cables first to prevent damage that might occur if wire leads removed from alternator should be grounded to tractor.

Disconnect wires from alternator. Slip fan belt off and remove the alternator.

Disassembly

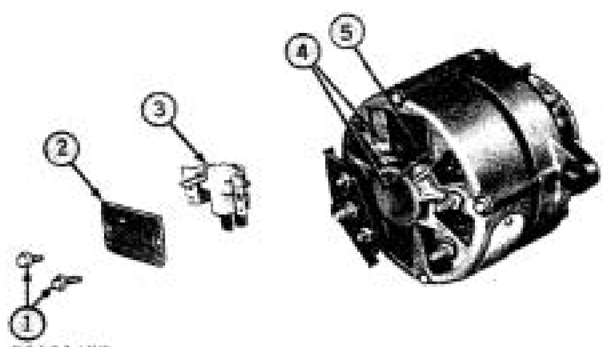
Never immerse an alternator in cleaning solution. When necessary, scrape off most of the dirt and grease, then use a stiff brush and solvent. Dry with compressed air.

IMPORTANT: Never hammer or jar an alternator or diodes. To do so may ruin the diodes.

Disassemble alternator only as far as necessary to correct the difficulty.

Removing and Cleaning Brushes

Clean alternator brushes will assure full charging of the alternator at all times.



1—Screws
2—Cover
3—Brush Assembly
4—Locating Pins
5—Slip Rings

Fig. 2-Alternator Brush Assembly

Remove the two self-tapping screws and cover. Grasp the field terminal, exert slight downward pressure and pull brush assembly back until it clears the two locking pins. Then tilt the assembly back at approximately a 45° angle and pull it straight out.

Replace the brush assembly if the brushes are excessively worn. The entire assembly is replaced rather than just the brushes.

If the brushes become clogged with dust or dirt, remove the dirt with compressed air. It is well to refrain from cleaning brushes with any type of liquid, since this would increase the possibility of any dust or dirt hardening within the brush cavity and hinder the movement of the brush.

It may become necessary to use a nonpetroleum base cleaning solvent to clean the slip rings, should they become contaminated. If this is not sufficient, then it is necessary to use crocus cloth to clean the slip rings.

Pulley Removal

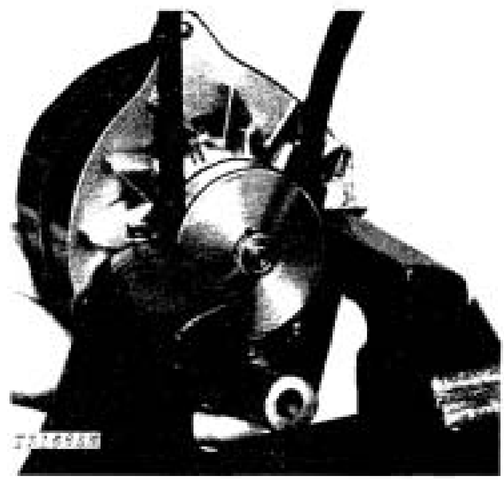
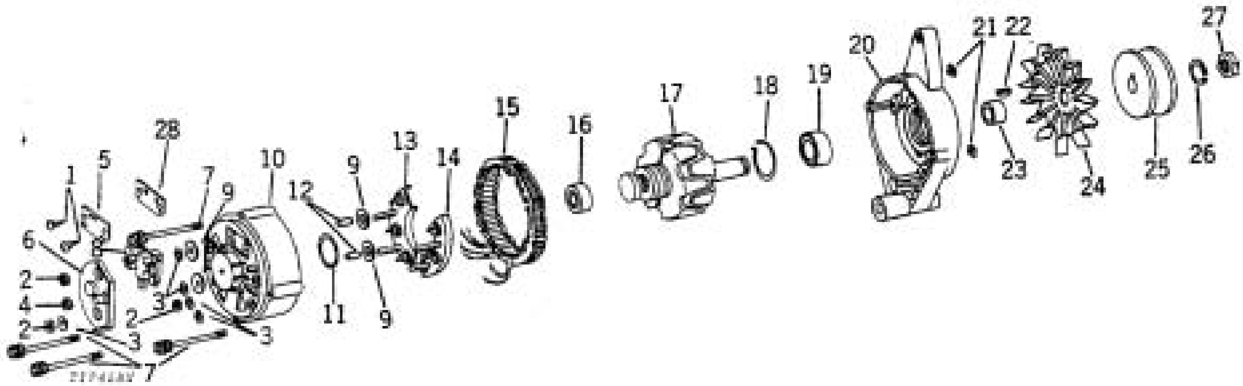


Fig. 3-Pulley Removal

The pulley is a slip fit on shaft with a Woodruff key. To remove the nut and lockwasher, clamp pulley in vise as shown in Fig. 3. Belt protects pulley from damage. While supporting alternator, strike end of shaft with a wooden mallet or plastic hammer.



1—No. 8 Screw (2 used)
2—No. 10 Nut (8 used)
3—No. 10 Lock Washer (8 used)
4—1/4" Nut
5—Brush Holder Cover
6—Isolation Diode Plate
7—Through Bolt (4 used)
8—Brush Assembly
9—Insulator Washer (5 used)
10—Rear Housing
11—Rear Bearing Retainer
12—Insulator Sleeve (2 used)
13—Positive Rectifier Diode Assembly
14—Negative Rectifier Diode Assembly
15—Stator
16—Rear Bearing
17—Rotor
18—Front Bearing Retainer
19—Front Bearing
20—Front Housing
21—No. 10 Square Nut
22—1/8" x 5/8" Woodruff Key
23—Spacer
24—Fan
25—Pulley
26—5/8" Lock Washer
27—5/8" Jam Nut
28—Dust Shield

Fig. 4-Alternator Assembly

Removing Rear Housing

Remove brush assembly, then remove isolation diode assembly (Fig. 5). Remove the four through bolts and nuts. Insert a small-bladed screwdriver in the stator slots between stator and front housing.

IMPORTANT: Do not insert screwdriver blade deeper than 1/16-inch [1.588 mm] to avoid damaging stator winding.

Apply prying pressure at several points around the stator to extract rotor and front housing as an assembly. Do not burr the stator core which would make reassembly difficult.

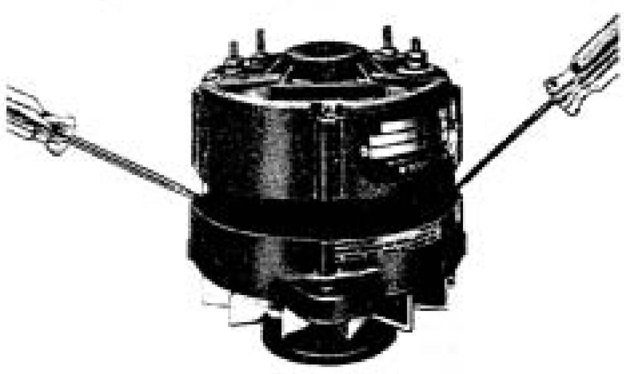


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Fig. 5-Removing Rear Housing

Rear Bearing

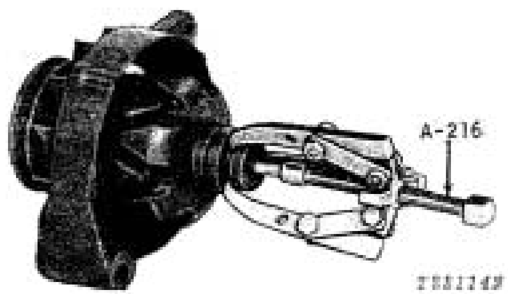


Fig. 6-Removing Rear Bearing

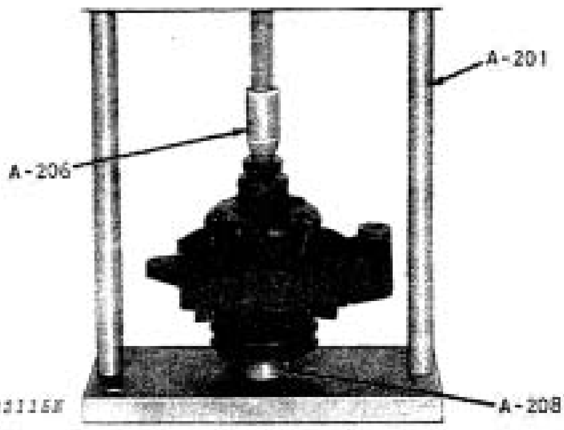
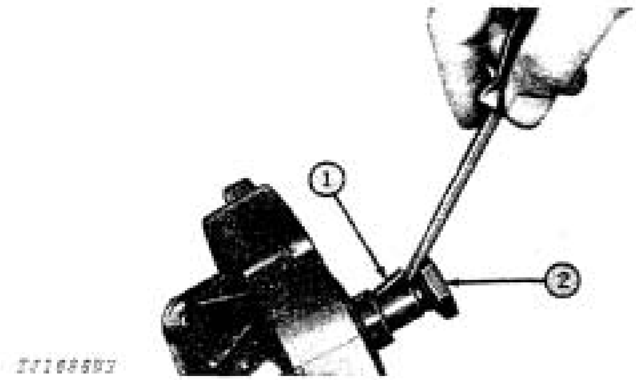


Fig. 7-Installing Rear Bearing

Figs. 6 and 7 show rear bearing replacement. Also replace O-ring bearing retainer in rear housing.

Front Bearing

Figs. 8 through 12 illustrate front bearing replacement. Remove front housing by tapping rotor shaft against a wood block or use A-216 puller. Remove bearing with A-216 puller. Compress the waves of the bearing retainer (Fig. 11) to seat it in its groove. Do not use a screwdriver or other small object that might slip off and damage the bearing seal. A-209 presses against the inside diameter of the bearing (Fig. 12).



1—Woodruff Key **2—Pulley Nut**

Fig. 8-Removing Woodruff Key

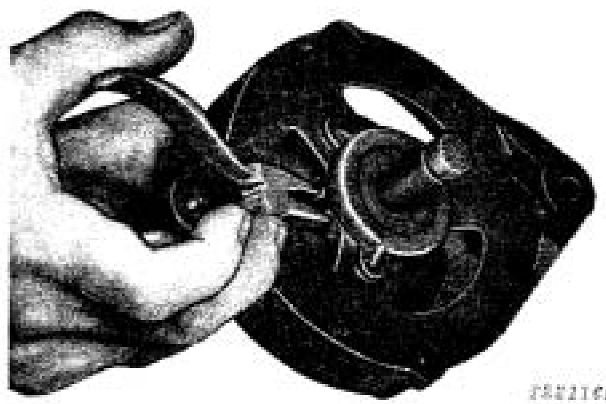


Fig. 9-Compressing Bearing Retainer

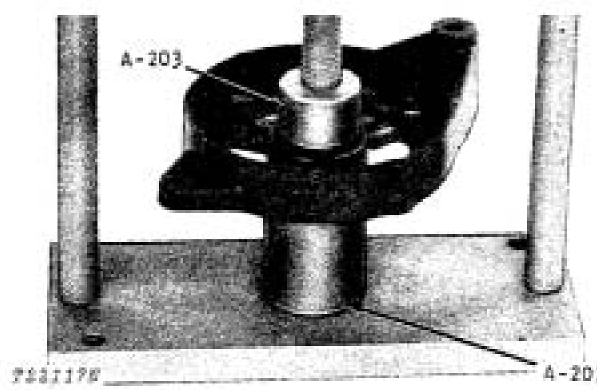


Fig. 10-Installing Front Bearing

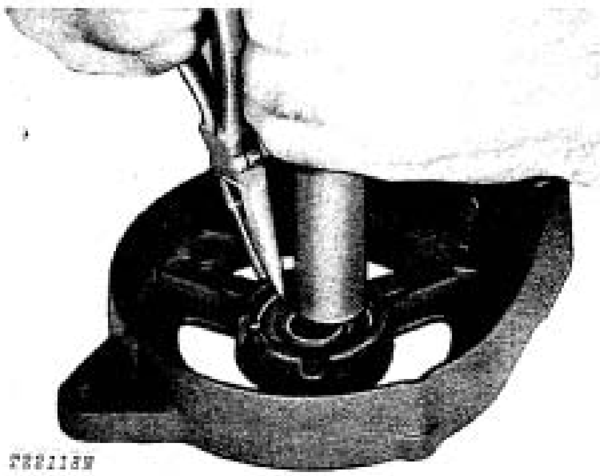


Fig. 11-Installing Bearing Retainer

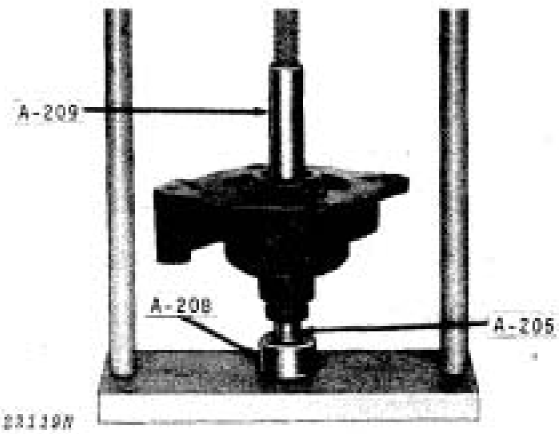


Fig. 12-Installing Front Housing

Removing Stator and Diodes

Remove stator and diode assembly from the rear housing. Carefully note locations of insulators and washers for proper reassembly. Do not unsolder stator-to-diode wire junctions. Avoid bending stator wires at junction.

When soldering and unsoldering leads from diodes, grasp the diode lead with pliers between the diode and the stator lead to be removed (Fig. 13). This gives better heat dissipation and protects the diode. Do not exert excessive stress on diode lead.

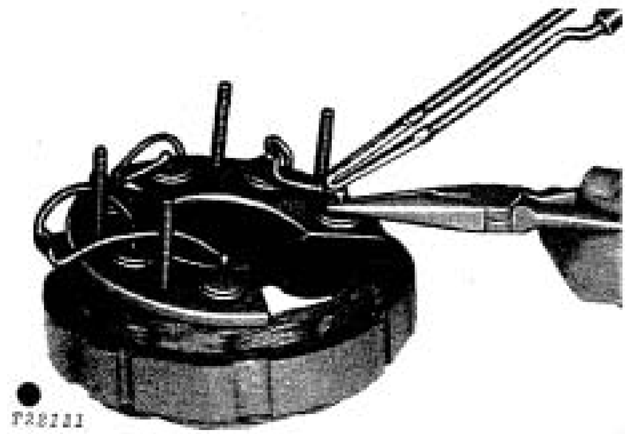


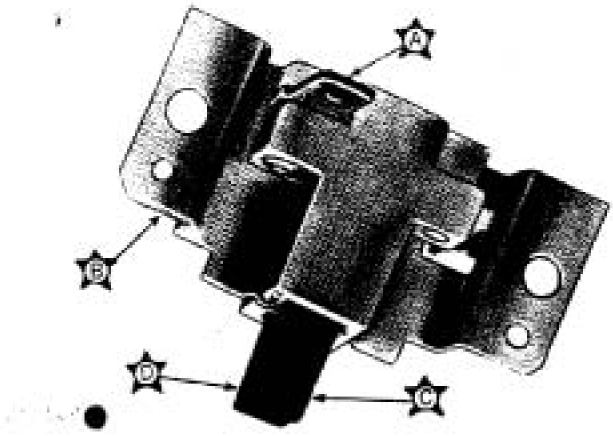
Fig. 13-Pliers Used as a Heat Sink

Note diode assembly to stator connections. Be sure replacement diode assembly connections are the same. The positive diode assembly has red printing and the negative has black printing—DO NOT INTERCHANGE.

Do not use an acid-core solder when soldering diode leads. Use rosin-core solder.

ALTERNATOR COMPONENT TESTS

Brush Assembly Insulation and Continuity Tests



A—Field Terminal
B—Bracket
C—Insulated Brush
D—Grounded Brush

Fig. 14-Brush Installation and Continuity Test Points

Insulation Test

Connect ohmmeter or a test lamp (12 to 120-volt to field terminal and bracket (test points A and B) as shown in Figure 14.

Resistance should be high (infinite) or test lamp should not light. If resistance is low or test lamp lights, brush assembly is shorted and must be replaced.

Continuity Test

Connect an ohmmeter to field terminal and brush (test points A and C). Use an alligator clip to assure good contact to brush. Resistance reading should be zero. Move brush and brush lead wire to make certain that the brush lead wire connections are not intermittent. Resistance reading should not vary when brush and lead wire is being moved around.

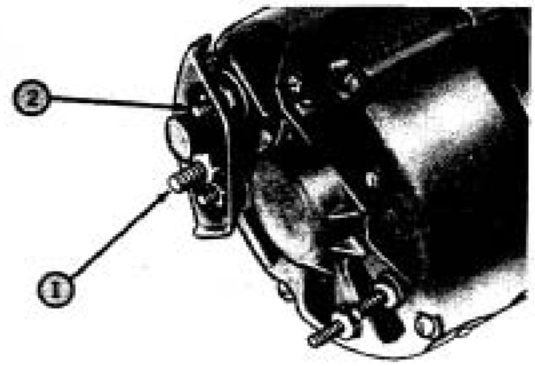
Connect ohmmeter to bracket and grounded brush (test points B and D). Resistance reading should be zero. Repeat same test on brush lead wire as described in above paragraph.

Replace brush assembly if brush exposed length is 1/4 inch [6.350 mm] or less.

Isolation Diode Test

If a commercial diode tester is used, follow tester manufacturer's testing instructions. If a commercial tester is not available, use a DC test lamp.

DO NOT USE A 120-VOLT TEST LAMP. USE A 12-VOLT DC TEST LAMP ONLY, otherwise diodes will be damaged.



T82330N

1—Output Terminal
2—Regulator Terminal

Fig. 15-Isolation Diode Test Points

Connect the test lamp to output terminal and regulator terminal (test points 1 and 2) as shown in Figure 15.

Then reverse test probes. The test lamp should light in one direction but should not light in the other direction. If the test lamp lights in both directions, the isolation diode is shorted. If the test lamp does not light in either direction, isolation diode is open.

Repeat test after isolation diode has been removed to ascertain findings.

In-Circuit Rectifier Diode Test

Any commercial in-circuit diode tester will suffice to make this check. Follow tester manufacturer's recommended testing procedure.

If the in-circuit tester indicates that diodes are faulty, recheck diodes individually after the diode assemblies have been disconnected from stator assembly (Fig. 19).

Shorted stator coil or shorted insulating washers or sleeves on positive diode assembly would make diodes appear to be shorted.

To check the negative diode assembly, connect tester to test points 1 and 2 as shown in Figure 16. Then successively check the two remaining diodes in the same manner (to ground terminal and diode lead).

To check the positive diode assembly, connect tester to the output terminal and one of the positive diode terminals. Repeat operation for remaining two positive diodes.

Rectifier Diode Test Using a Test Lamp

Test lamp will not indicate an open condition unless ALL THREE DIODES of either assembly are open. However, a shorted diode can be detected. This test is not completely reliable, but can be used when an in-circuit diode tester is not available.

DO NOT USE A 120-VOLT TEST LAMP. USE A 12-VOLT DC TEST LAMP ONLY; otherwise diodes will be damaged.

A. Negative Diodes - Connect test lamp probes to test points 1 and 2 (Fig. 16), then reverse test probes. The test lamp should light in one direction but not in the other direction. If the test lamp lights in both directions, one or more of the rectifier diodes of the assembly being tested is shorted. If the test lamp does not light in either direction, ALL THREE DIODES IN THE ASSEMBLY ARE OPEN. Recheck diodes individually after disassembly to ascertain findings (Fig. 19).

A shorted stator coil to core would appear as a shorted negative rectifier diode assembly. Also check stator for shorts after disassembly. (See next page.)

B. Positive Diodes - Connect test probes to regulator terminal and to terminal of top position diode. Then reverse test probes. The same procedure and results apply as in paragraph "A" above.

Rotor Leakage (Shorts) Test

This test checks the field coil for leakage or shorts to rotor poles. An ohmmeter to test lamp (12-volt or 120-volt) may be used.

A. Remove the brush assembly.

B. Connect ohmmeter or test lamp test probes to one of the slip rings and ground terminal.

Ohmmeter resistance should be infinite (test lamp should not light). If resistance is not infinite (test lamp lights), leakage or a short exists between field coil and rotor.

Repeat test after rotor has been removed from alternator to ascertain findings. Connect test probes to one of the slip rings and to rotor shaft.

In-Circuit Stator Leakage (Shorts) Test

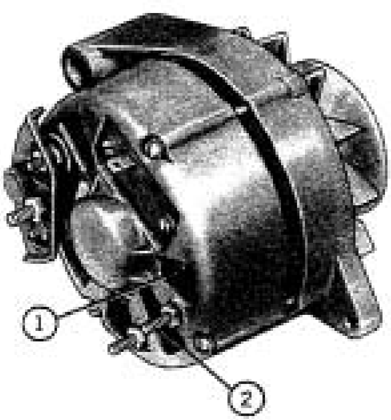


Fig. 16-In-Circuit Stator Leakage (Shorts) Test

When making the "in-circuit" stator leakage test, some consideration must be given to the rectifier diodes that are connected to the stator winding. The negative rectifier diode assembly will conduct in one direction when properly polarized. A shorted diode in the negative rectifier diode assembly would make stator appear to be shorted. For this reason, the rectifier diode plate assembly and stator must be checked individually after alternator has been disassembled if the problem is localized to the stator.

DO NOT USE A 120-VOLT TEST LAMP. USE A 12-VOLT DC TEST LAMP ONLY, otherwise diodes will be damaged.

A. Connect the test lamp to a diode terminal of the negative diode assembly and ground terminal (Test points 1 and 2) as shown in Fig. 16.

B. Reverse test probes. The test lamp should light in one direction but not in the other.

If the test lamp does not light in either direction, this indicates that all three rectifiers in the negative diode assembly are open.

If the test lamp lights in both directions, the stator winding is shorted to stator or one of the negative rectifier diodes is shorted. Recheck stator and rectifier diode assembly after disassembly to ascertain findings.

Out-of-Circuit Stator Leakage (Shorts) Test

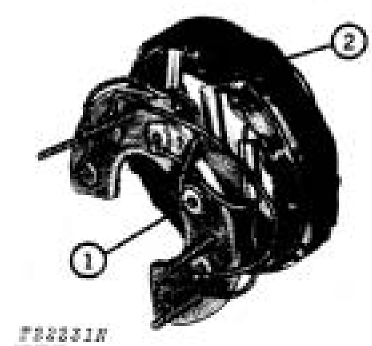


Fig. 17-Stator Leakage Test Points

Disassemble alternator and remove the rectifier diode plates and stator as an assembly as shown in Fig. 17.

An ohmmeter or test lamp (12-volt) may be used.

Connect ohmmeter or test lamp probes to one of the rectifier diode terminals and to stator (test points 1 and 2) as shown in Fig. 17.

Resistance reading should be infinite or test lamp should not light. If resistance reading is not infinite or test lamp lights, high leakage or a short exists between stator winding and stator. In either case, stator should be replaced.

Stator

Examine stator for insulation failure or defects. Shorted stator windings are usually discolored and smell. Replace stator only after other electrical components have been proven to be satisfactory.

If a sensitive ohmmeter is available, use the following procedure.

1. Disconnect the stator leads from the diode assemblies.

2. Check for a grounded winding by connecting an ohmmeter to one stator lead and to the stator frame. The ohmmeter reading should be infinite.

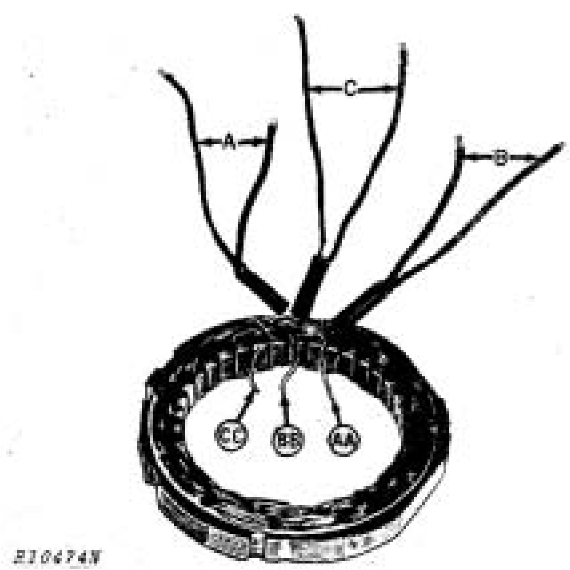


Fig. 18-Stator Leads

3. To check for an open-circuited or a short-circuited winding, carefully zero the ohmmeter and connect the ohmmeter leads to A and B (Fig. 18). The meter reading should be approximately 0.4 ohm. An infinite or high reading indicates an open-circuited winding. Now touch the remaining A and B leads together several times. The meter pointer should deflect slightly to zero. If there is no pointer movement, the windings are shorted.

4. Check for an open circuit or a short circuit between A and C and between B and C.

If a sensitive ohmmeter is not available for the above procedures, carefully disconnect the stator leads AA, BB, and CC from each other. (Stator leads may be brittle if they have been overheated or if they are old.) Test the stator as instructed in FOS Manual 20—ELECTRICAL SYSTEMS.

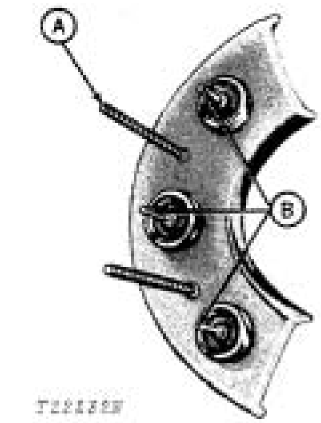
FOS

Out-of-Circuit Rectifier Diode Test

If a commercial "Alternator Rectifier Diode Tester" is used, follow the tester manufacturer's recommended testing procedure.

If a commercial tester ohmmeter is not readily available, check diodes with a test lamp. DO NOT USE A 120-VOLT TEST LAMP. USE A 12-VOLT DC TEST LAMP ONLY, otherwise diodes will be damaged.

When unsoldering the stator wires from the rectifier diode assembly, provide a heat sink to the diode terminal with long-nosed pliers.



A—Diode Plate Stud B—Diode Terminals

Fig. 19-Rectifier Diode Test Points

Connect the test lamp probes to diode terminal and diode plate stud (see Fig. 19) then reverse test lamp probes. The test lamp should light in one direction but not in the other.

If test lamp lights in both directions, the diode is shorted. If the test lamp does not light in either direction, the diode is open.

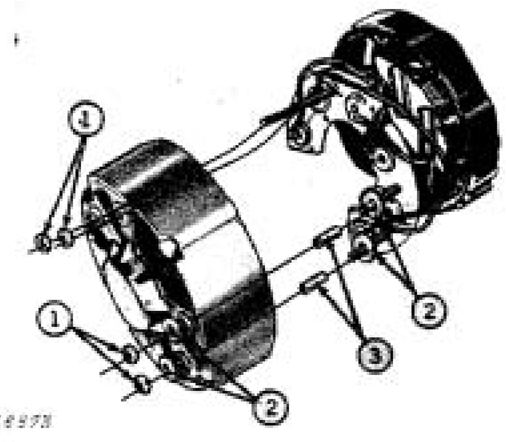
Test the remaining diodes of the assembly in the same manner. Replace entire assembly if one of the diodes is found to be faulty.

When testing with an ohmmeter, if a needle deflection is observed with the positive lead to the diode stem and negative lead to the case, the diode is positive. The reverse is true for a negative diode.

Positive diodes have red printing and negative diodes have black printing. DO NOT INTERCHANGE THEM.

ASSEMBLY

Assembling Stator and Rear Housing



1—No. 10 Nut
2—Insulating Washers
3—Insulating Sleeve

Fig. 20-Stator and Rear Housing Assembly

Assemble stator to rear housing making sure insulating washers and sleeves are positioned as shown in Fig. 20.

Assembling Rear Housing to Front Housing

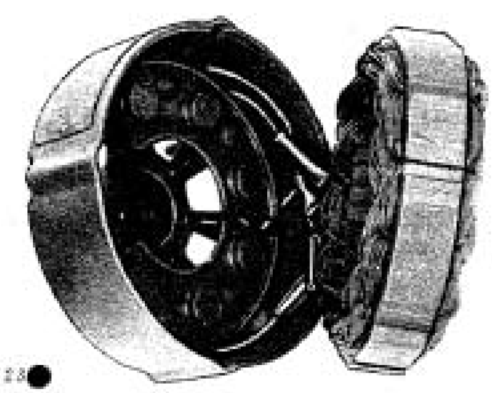


Fig. 21-Stator and Slip Ring End Frame

Position stator leads to prevent interference with rotor (Fig. 21). Assemble stator and slip ring end frame to the rotor and drive end frame. Tighten through bolts to 50 to 60 lb-in. [0.576 to 0.691 kg-m] torque. Install brush assembly and tighten screws to 20 to 30 lb-in. [0.330 to 0.346 kg-m] torque.

Seal small hole at center of bearing boss in slip ring end frame.

Assembly of Isolation Diode

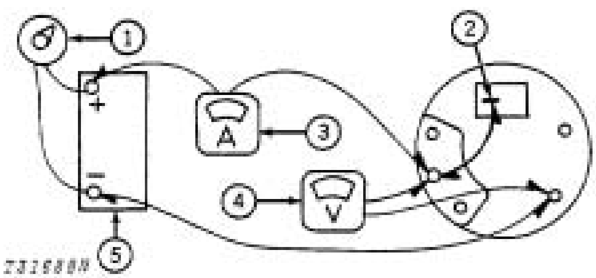
Before mounting isolation diode, make certain that the positive rectifier diode plate has been properly insulated from housing (Fig. 20).

The isolation diode is mounted to the positive rectifier diode studs. Mount isolation diode as shown in Fig. 15.

Pulley Installation

To facilitate tightening pulley retainer lock washer and nut, position Woodruff Key, fan and pulley on shaft and grasp in vise with a belt protecting the pulley as shown in Fig. 3. Tighten pulley nut to 40 to 50 lb-ft. [5.530 to 6.913 kg-m].

TESTS AFTER ASSEMBLY



1—Carbon Pile Resistor
2—Field Terminal
3—Ammeter
4—Voltmeter
5—12-Volt Battery

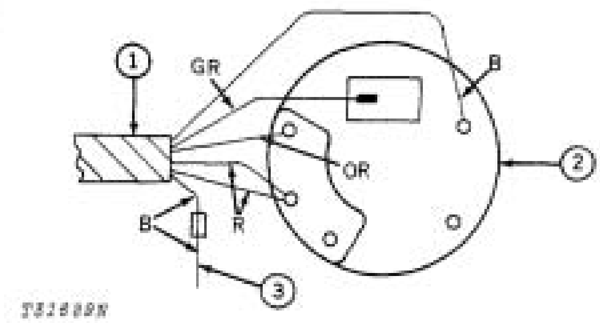
Fig. 22-Alternator Test Connections

Mount alternator on electrical servicer. If servicer instructions are not available, connect alternator as shown in Fig. 22. Run alternator at 3000 rpm. Adjust resistor to obtain 15 volts. The ammeter reading should be 29 amps or more.

INSTALLATION

Install alternator. Apply force only to the front alternator frame when adjusting belt tension. (See Section 70, Group 10 for adjusting belt tension.)

Connect alternator wires (Fig. 23) making sure all connections are clean and tight. Connect battery ground. Do not polarize.

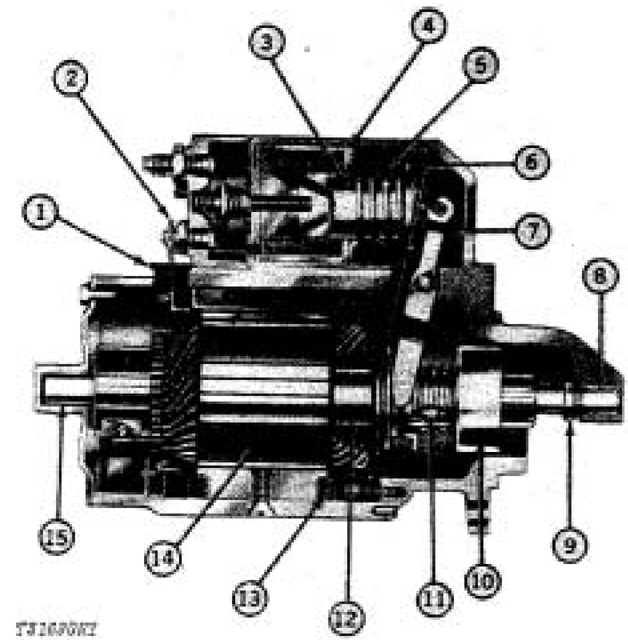


1—Main Wire Harness
2—Alternator
3—To Fuel Gauge Sender

Fig. 23-Alternator Connections

Group 15
STARTING SYSTEM

GENERAL INFORMATION



1—Grommet
2—Field Connectors
3—Plunger
4—Solenoid
5—Return Spring
6—Brake Washer
7—Shift Lever
8—Bushing
9—Pinion Stop
10—Overrunning Clutch
11—Spiral Splines
12—Field Coil
13—Armature
14—Bushing

Fig. 1-Sectional View of Starting Motor

The starting motor consists of a drive housing, overrunning clutch and pinion, shift lever, field frame, solenoid, armature, field coil assembly, brushes and commutator end frame.

The shift lever mechanism and the solenoid plunger are enclosed in the drive housing to protect them from exposure to dirt, icing conditions and splash.

Armature

The armature is supported on two bushings in the drive housing and commutator end frame. The armature assembly consists of a stack of iron lamenation located over a steel shaft, a commutator assembly and the armature windings. The windings are heavy copper ribbon that are assembled into slots in the iron laminations. The winding ends are soldered or welded to the commutator bars which are electrically insulated from each other and from the iron shaft.

Field Windings

The frame and field assembly consists of field windings assembled over iron pole pieces which are attached to the inside of a heavy iron frame. The iron frame and pole shoes not only provide a place onto which the field coils can be assembled, but also provide a low reluctance, or low resistance path for the magnetic flux produced by the field coil windings.

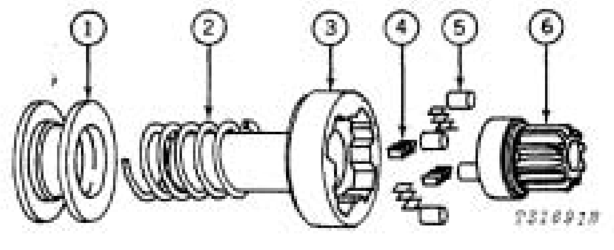
Solenoid Switch

The solenoid switch consists basically of two windings mounted around a hollow cylinder containing a moveable core or plunger. A shift lever is connected to the plunger, and a push rod and contact disk are assembled in line with the plunger.

The two windings in the solenoid are called the hold-in winding and the pull-in winding. The hold-in winding contains many turns of fine wire, and the pull-in winding the same number of turns of larger wire.

On gasoline tractors, the solenoid terminal "R" is connected to the ignition coil to bypass the ignition resistor when starting.

Overrunning Clutch Drive



1—Collar
2—Spring
3—Shell
4—Spring
5—Rollers
6—Pinion

Fig. 2-Overrunning Clutch

The overrunning clutch drive has a shell and sleeve assembly which is splined internally to match splines on the armature shaft. The pinion is located inside the shell along with the spring-loaded rollers that are wedged against the pinion and taper cut inside the shell. The springs may be either the helical or accordian type, and four rolls are used. A collar and spring located over the sleeve are the other major components.

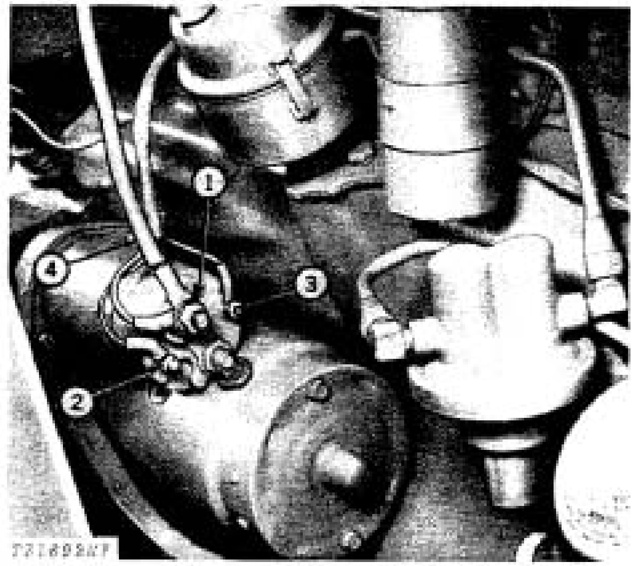
The overrunning clutch drive is designed to be serviced as a complete unit, therefore, do not disassemble. Replace if necessary.

An important service check on roll clutches involves the clearance in the crank position between the pinion and pinion stop with the pinion pushed back toward the shift lever. Proper clearance is needed to prevent rubbing of the collar against the shift lever during motor operation and to insure proper engagement before cranking begins.

Never run the starting motor more than twenty seconds at a time or overheating will result. Allow motor to cool at least two minutes before running it again.

FOS For additional information on starting motors, refer to "Starting Circuits" in FOS Manual - ELECTRICAL SYSTEMS.

REMOVAL



1—"BAT" Terminal
2—"R" Terminal
3—"S" Terminal
4—Battery Positive Cable

Fig. 3-Starting Motor Wiring

Disconnect battery ground strap.

Disconnect battery positive cable (4) and wires from solenoid.

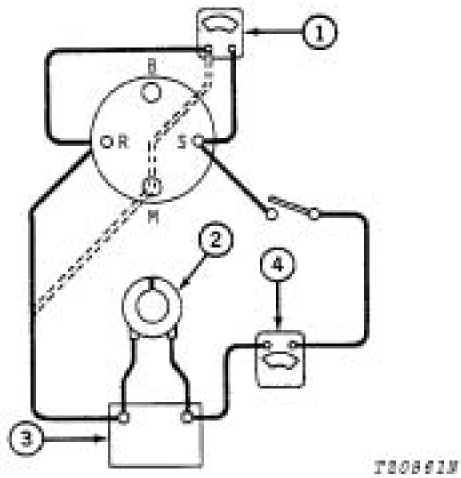
Remove the mounting cap screw and stud nut. Remove starting motor from engine.

TESTING AND DIAGNOSIS

Solenoid Tests (Starting Motor Removed)

Testing Pull-In Windings

Disconnect field connector from solenoid motor terminal. Connect ammeter in series with a carbon pile resistor to terminal "S" and to battery. Connect voltmeter to terminal "S" and to solenoid motor terminal (Fig. 4). With carbon pile in the off position, connect other battery post to solenoid motor terminal. Quickly adjust the carbon pile to obtain 5 volts. The ammeter reading should be 13 to 15.5 amps.



1—Voltmeter
2—Carbon Pile
3—Battery
4—Ammeter

Fig. 4-Solenoid Test Points

Testing Hold-In Windings

Disconnect solenoid. Connect ammeter in series with a switch to terminal "S" and to battery. Connect voltmeter to terminal "S" and to solenoid ground. Connect carbon pile resistor across the battery. Connect other battery post to solenoid ground. Close the switch and adjust carbon pile to obtain 10 volts. The ammeter reading should be 14.5 to 16.5 amps.

High Ammeter Reading

Windings are grounded or shortcircuited.

Low Ammeter Reading

Excessive resistance is present (usually in a connection).

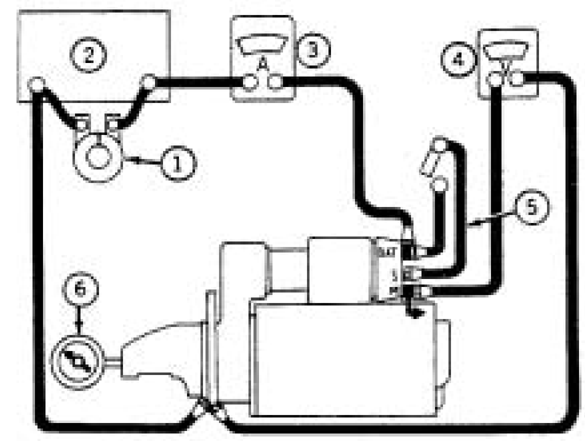
No Ammeter Reading

Windings are open circuited.

To prevent overheating, do not energize the pull-in winding longer than 20 seconds. Current draw will decrease as the winding temperature increases.

If the fault cannot be repaired and the solenoid performance is questionable, replace the windings.

Starting Motor No-Load Test



T63939N

1—Carbon Pile
2—Battery
3—Ammeter
4—Voltmeter
5—Jumper Lead With Switch
6—Tachometer

Fig. 5-No-Load Test Hook-Up

Make connections shown in Fig. 5. Close switch to operate starting motor and adjust carbon pile to obtain specified voltage. Current draw and rpm should be as follows:

Motor No.	Test Volts	Min. Amps	Max. Amps	Min. RPM	Max. RPM
(Gasoline)					
1108319	9.0	55*	80*	3500	6000
(Diesel)					
1107871	9.0	40*	140*	8000	13000

**Includes solenoid.*

Interpret the test results as follows:

1. Rated current draw and no-load speed indicates normal condition of the starting motor.

2. Low free speed and high current draw indicates:

a. Too much friction - tight, dirty, or worn bearings, bent armature shaft or loose pole shoes allowing armature to drag.

b. Shorted armature. This can be further checked on a growler after disassembly.

c. Grounded armature or fields. Check further after disassembly.

3. Failure to operate with high current draw indicates:

a. A direct ground in the terminal or fields.

b. Frozen bearings (this should have been determined by turning the armature by hand).

4. Failure to operate with no current draw indicates:

a. Open field circuit. This can be checked after disassembly by inspecting internal conditions and tracing circuit with a test lamp.

b. Open armature coils. Inspect the commutator for badly burned bars after disassembly.

c. Broken brush springs, worn brushes, high insulation between the commutator bars or other causes which would prevent good contact between the brushes and commutator.

5. Low no-load speed and low current draw indicates:

a. High internal resistance due to poor connections, defective leads, dirty commutator and causes listed under no. 4.

6. High free speed and high current draw indicates shorted fields. If shorted fields are suspected, replace the field coil assembly and check for improved performance.

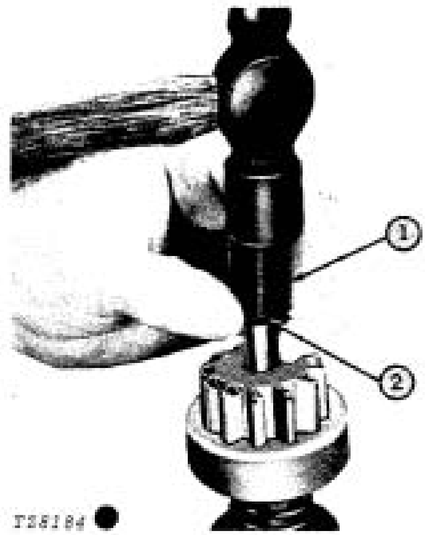
REPAIR

Disassemble motor only as far as necessary to make repairs (Fig. 7 or 8).

Mark position of commutator end frame with regard to main frame to aid in alignment during reassembly.

Disconnect field coil connector from solenoid motor terminal and remove solenoid mounting screws.

Remove commutator end frame. Remove field frame and solenoid from drive housing. Separate armature and clutch assembly from drive housing.



1—Pipe Coupling **2—Pinion Stop**

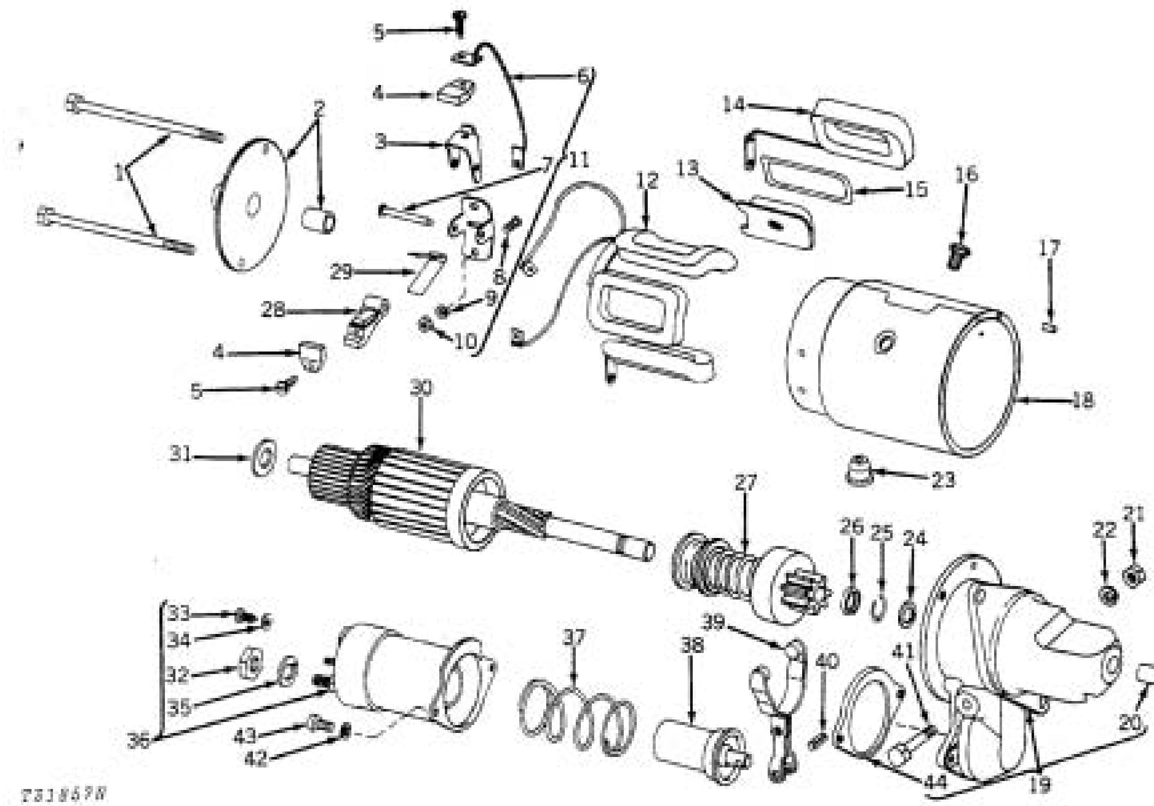
Fig. 6-Removing Retainer

Slide a standard half-inch pipe coupling onto the shaft so it butts against the pinion stop. Tap coupling, driving stop toward the armature end, off the retaining ring (Fig. 6).

Remove retaining ring. If it is badly distorted, use a new retaining ring when reassembling the clutch.

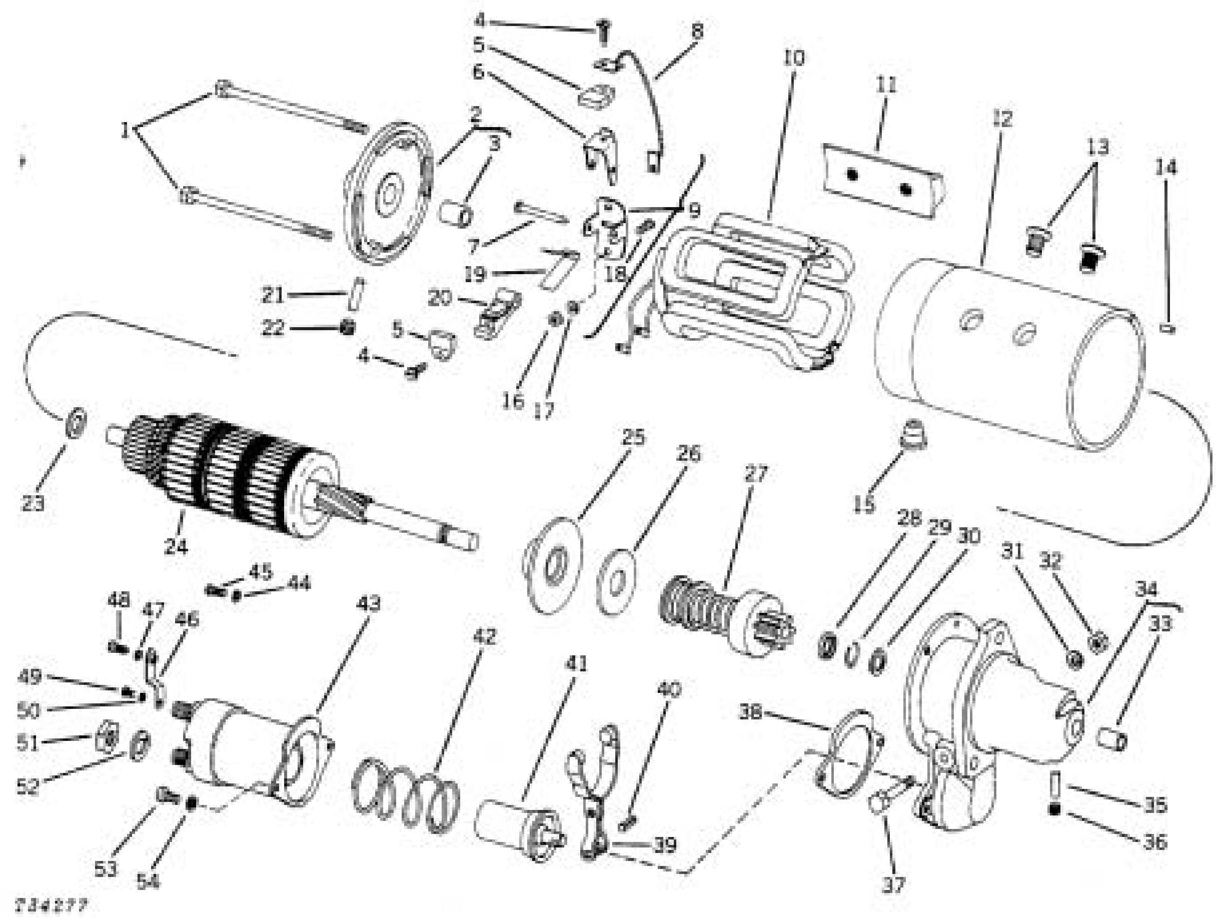
Remove armature and clutch from lever housing and separate solenoid from the housing.

Do not clean any parts in grease dissolving solvents. Wipe the drive with a clean cloth.



1—Through Bolt (2 used)
2—Commutator End Assembly
3—Grounded Brush Holder (2 used)
4—Brush (4 used)
5—No. 8 x 5/8" Drive Screw (4 used)
6—Lead Assembly (2 used)
7—Brush Pin (2 used)
8—No. 10 x 1/2" Machine Screw (4 used)
9—No. 10 Lock Washer (4 used)
10—No. 10 Nut (4 used)
11—Brush Support Package
12—Field Coil Assembly
13—Pole Shoe (4 used)
14—Field Coil Shunt
15—Insulator (4 used)
16—Special Screw (4 used)
17—Dowel Pin
18—Field Frame
19—Motor Drive Housing
20—Bushing
21—5/16" Jam Nut
22—5/16" Lock Washer
23—Grommet
24—Thrust Washer
25—Retaining Ring
26—Pinion Stop
27—Overrunning Clutch Assembly
28—Insulated Brush Holder (2 used)
29—Brush Spring (2 used)
30—Armature
31—Brake Washer
32—3/8" Jam Nut
33—No. 10 x 7/16" Special Machine Screw
34—No. 10 Internal Tooth Lock Washer
35—3/8" Lock Washer
36—Solenoid Switch
37—Plunger Spring
38—Plunger
39—Shift Lever
40—3/16" x 13/16" Spring Pin
41—Special Cap Screw
42—1/4" Lock Washer (2 used)
43—1/4" x 1/2" Machine Screw (2 used)
44—Solenoid Gasket

Fig. 7-Starting Motor (Gasoline)



1—Through Bolt (2 used)
2—Commutator End
3—Bushing
4—Drive Screw (4 used)
5—Brush (4 used)
6—Insulated Brush Holder (2 used)
7—Brush Pin (2 used)
8—Lead Assembly (2 used)
9—Support Assembly (2 used)
10—Field Coil Assembly
11—Pole Shoe (4 used)
12—Field Frame
13—Machine Screw (8 used)
14—Dowel Pin
15—Grommet
16—Nut (4 used)
17—Lock Washer (4 used)
18—Machine Screw (4 used)
19—Brush Spring (4 used)
20—Brush Holder (2 used)
21—Commutator End Wick
22—Pipe Plug
23—Commutator End Spacer
24—Armature
25—Center Bearing Plate
26—Brake Washer
27—Motor Drive
28—Collar
29—Retaining Ring
30—Drive End Spacer
31—Lock Washer
32—Jam Nut
33—Bushing
34—Drive Housing
35—Drive End Wick
36—Pipe Plug
37—Screw
38—Solenoid Gasket
39—Shift Lever
40—Spring Pin
41—Solenoid Switch Plunger
42—Spring
43—Solenoid Switch Assembly
44—Lock Washer (2 used)
45—Screw (2 used)
46—Connector
47—Lock Washer
48—Screw
49—Screw
50—Lock Washer (2 used)
51—Nut
52—Lock Washer
53—Machine Screw (2 used)
54—Lock Washer

Fig. 8-Starting Motor (Diesel)

Checking Brushes

Inspect brushes. If they are oil soaked or are worn to approximately 5/16 inch [7.94 mm] replace them.

Make sure the brush holders are clean and the brushes are not binding in the holders. The full brush surface should ride on the commutator to give proper performance. Check by hand to insure that the brush springs are giving firm contact between the brushes and commutator. If the springs are distorted or discolored, they should be replaced.

To remove brush holders, slide pivot pins out. Tighten brushes after assembling starting motor.

Armature

If the commutator is excessively worn, dirty, out of round, or if it has high insulation, it should be turned down on a lathe and the insulation undercut 1/32 inch [0.792 mm] and 1/32 inch [0.792 mm] deep.

The commutator may be cleaned with No. 00 sand paper. Do not use emery cloth.

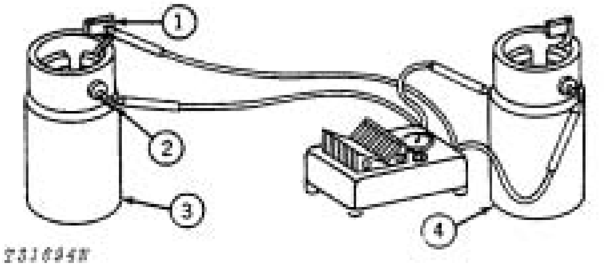
The armature should be checked for short circuits, opens and grounds.

1. Short circuits are located by rotating the armature in a growler with a steel strip such as a hacksaw blade held on the armature. The steel strip will vibrate on the area of the short circuit. Shorts between bars are sometimes produced by brush dust or copper between bars. Undercutting the insulation will eliminate these shorts.

2. Opens may be located by inspecting the points where the conductors are joined to the commutator for loose connections. Poor connections cause arcing and burning of the commutator. If the bars are not badly burned, leads originally soldered to the riser bars can be resoldered.

3. Grounds in the armature can be detected by the use of a test lamp. If the lamp lights when one test prod is placed on the commutator and the other test prod on the armature core or shaft, the armature is grounded. If the commutator is worn, dirty, out of round, or has high insulation, the commutator should be turned down.

Field Coils



1—Brush
2—Field Connector Terminal
3—Open Circuit Test
4—Grounded Winding Test

Fig. 9-Field Winding Test

The field coils should be checked for grounds and opens using a test lamp.

1. Grounds - Disconnect field coil ground connections. Connect one test prod to the field frame and the other to the field connector. If the lamp lights, the field coils are grounded and must be repaired or replaced.

2. Opens - Connect test lamp prods to ends of field coils. If lamp does not light field coils are open.

If the field coils need to be removed for repair or replacement, a pole shoe spreader and pole shoe screwdriver should be used. Care should be taken in replacing the field coils to prevent grounding or shorting them as they are tightened into place. Where the pole shoe has a long lip on the side, it should be assembled in the direction of armature rotation.

Overrunning Clutch Assembly

The pinion should turn smoothly with a slight drag in the overrunning direction and lock up in the opposite direction. If not, the entire clutch and pinion assembly must be replaced as the assembly cannot be repaired.

Bushings

Pre-Lubricated Bushings

When installing pre-lubricated bushings in the overrunning clutch, use an arbor (see "Special Tools") to prevent bearing collapse. After installation, check bushing size. Burnish bushing to size if necessary.

Wick-Lubricated Bushings

Remove pipe plugs, expansion plugs and oil wicks from housings. Press out old bushing. Press new bushing in to same depth as old bushing. Carefully drill bushing through oil wick hole using same size drill as oil wick hole.

After drilling, ream bushing to maintain proper oil clearance between shaft and bushing.

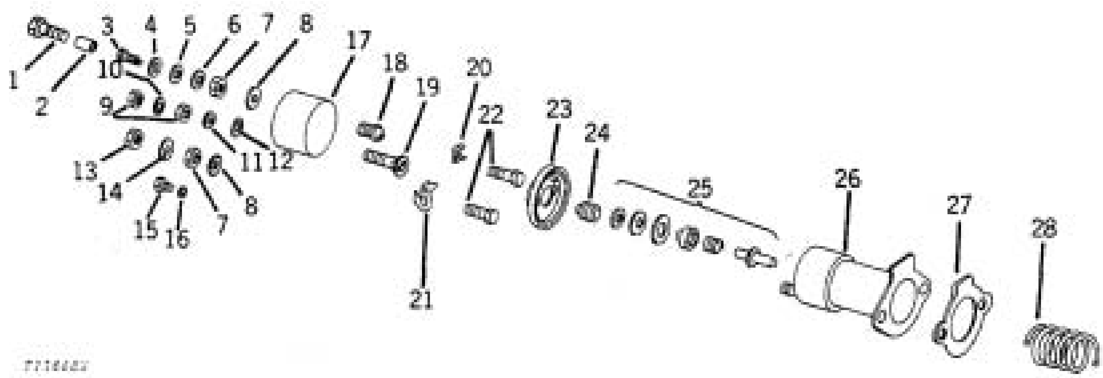
Soak new wicks in SAE 10 engine oil. Install wicks, expansion plugs and pipe plugs.

Bushing, Overrunning Clutch
I.D. .... 0.5620 - 0.5630 in. [14.274 - 14.300 mm]
Wear tolerance .... 0.5740 in. [14.579 mm]

Bushing, Drive Housing
I.D. .... 0.4990 - 0.5010 in. [12.674 - 17.725 mm]
Wear tolerance .... 0.5110 in. [12.979 mm]
Oil clearance .... 0.0020 - 0.0050 in. [0.050 - 0.127 mm]
Wear tolerance .... 0.0170 in. [0.431 mm]

Bushing, Commutator End Frame
I.D. .... 0.5625 - 0.5635 in. [14.288 - 14.312 mm]
Wear tolerance .... 0.5730 in. [14.554 mm]
Oil clearance .... 0.0020 - 0.0050 in. [0.050 - 0.127 mm]
Wear tolerance .... 0.0160 in. [0.406 mm]

Solenoid Switch



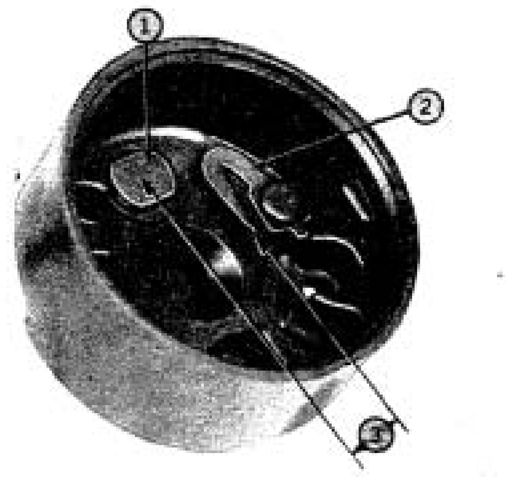
1—Terminal Screw
2—Connector
3—Machine Screw
4—Lock Washer
5—Washer
6—Washer
7—Jam Nut (2 used)
8—Sealing Washer (2 used)
9—Nut (4 used)
10—Lock Washer (2 used)
11—Washer
12—Washer
13—Jam Nut
14—Lock Washer
15—Machine Screw (2 used)
16—Washer
17—Cover
18—Motor Terminal Stud
19—Battery Terminal Stud
20—Switch Terminal Clip
21—Contact
22—Switch and Resistor Terminal Stud (2 used)
23—Gasket
24—Return Spring
25—Contact Assembly
26—Case and Coil
27—Gasket
28—Return Spring

Fig. 10-Solenoid Switch

Remove nuts and sealing washers from solenoid motor and "S" terminals when removing switch cover.

The "R" terminal (for ignition bypass) contact finger height above the surface of the main contact (Fig. 11) should be 1/16 to 3/32 inch [0.792 to 2.383 mm]. Bend the finger to adjust contact height.

Replacement "S" terminal clips and motor terminal studs are soldered to winding leads. Use new sealing washers when assembling the solenoid.



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1—Main Contact
2—Contact Finger
3—Contact Finger Height Above Main Contact

Fig. 11-"R" Terminal Contact Finger

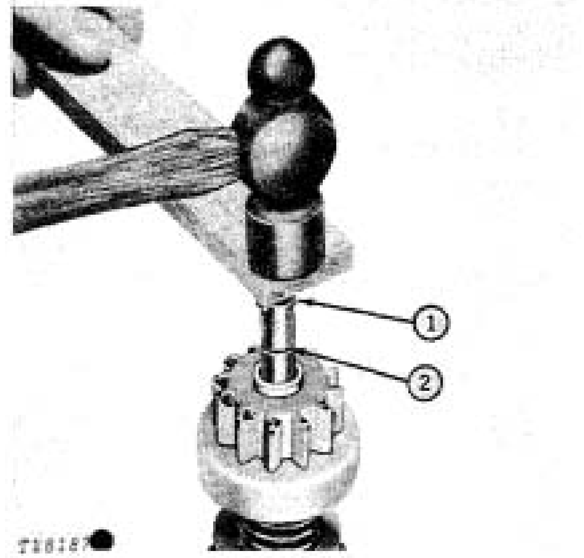
ASSEMBLY

To assemble starter, reverse the disassembly procedures.

Lubricate splines and drive end of armature shaft with SAE 10 engine oil. Heavier oil may cause failure to mesh at low temperature. Lubricate the bearing surfaces of the center bearing, drive end frame, and commutator end frame with Delco-Remy lubricant No. 1960954.

With overrunning clutch in place, install pinion stop with cupped side out and retaining ring.

Proceed as follows when assembling retaining ring and pinion stop on shaft.



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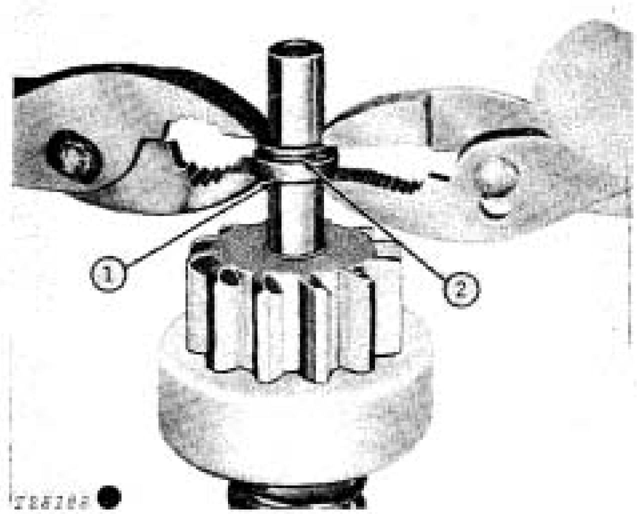
1—Retaining Ring **2—Groove**

Fig. 12-Forcing Retaining Ring over Shaft

1. With the pinion stop placed over the shaft (cupped surface facing the end of the shaft), force the retaining ring over the shaft with a light hammer blow and slide ring into the groove (Fig. 12).



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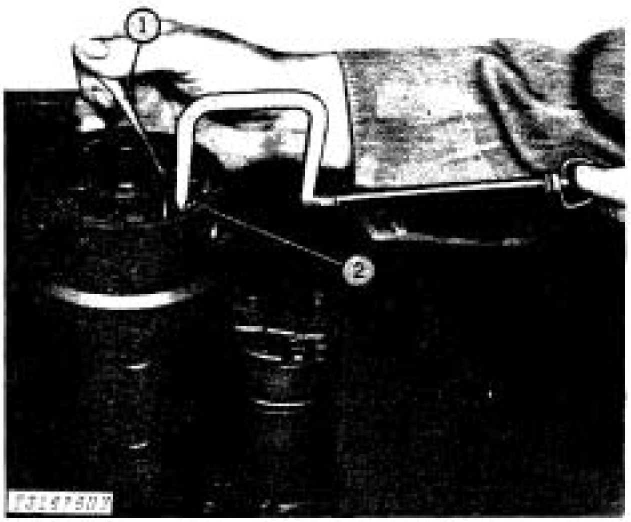
1—Pinion Stop **2—Retaining Ring**

Fig. 13-Forcing Pinion Stop over Retaining Ring

2. To force the pinion stop over the ring, place a suitable washer over the shaft and squeeze with pliers (Fig. 13). Remove the washer.

Carefully install field frame so that brush holders are not broken. Align brushes with commutator and tighten brushes.

If it is necessary to seat brushes, use No. 00 sandpaper. Clean all dust from starting motor.



1—Piece of Paper 2—Brush Attaching Screw

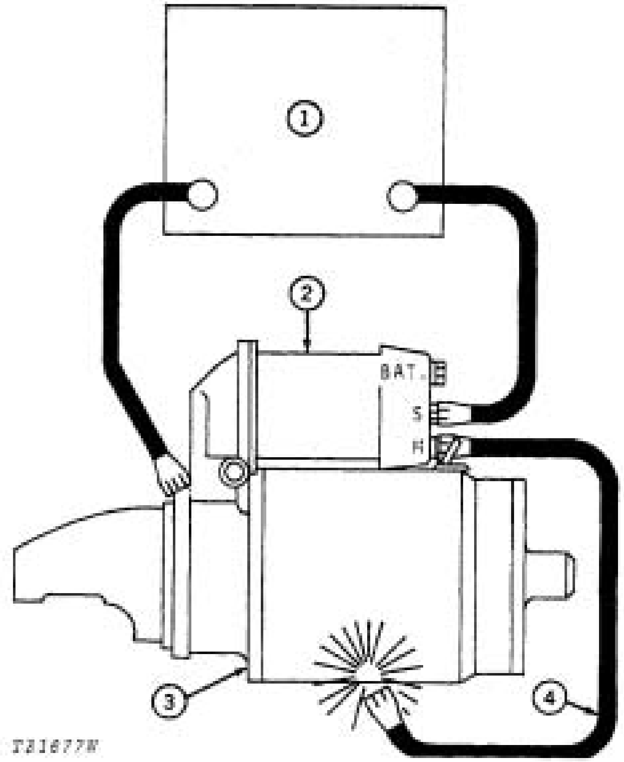
Fig. 14-Testing Brush Spring Tension

Place a piece of paper under the brush (Fig. 14). Hook a spring tension scale on the head of the brush attaching screw. Pull the scale on a line parallel to the brush and note the reading when the paper is released. Minimum brush spring tension is 35 ounces [992.25 g]. Bend springs if it is necessary to adjust the tension.

Pinion Clearance

The pinion clearance cannot be adjusted but should be checked after reassembly of the starting motor to insure proper clearance. Improper clearance is an indication of worn parts.

To check pinion clearance use the following steps:



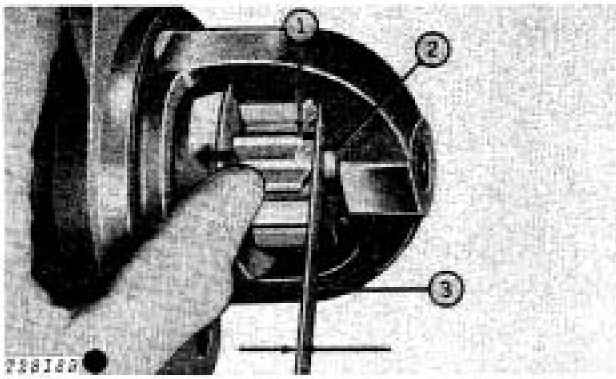
1—Battery
2—Solenoid
3—Starting Motor
4—Jumper Wire

Fig. 15-Circuit for Checking Pinion Clearance

1. Disconnect the motor field coil connector from the solenoid motor terminal and insulate it carefully.

2. Connect a battery, of the same voltage as the solenoid (12 volt), from the solenoid switch terminal to the solenoid frame (Fig. 15).

3. Momentarily flash a jumper lead from the solenoid motor terminal to solenoid frame. This will shift the pinion into cranking position and it will remain so until the battery is disconnected.



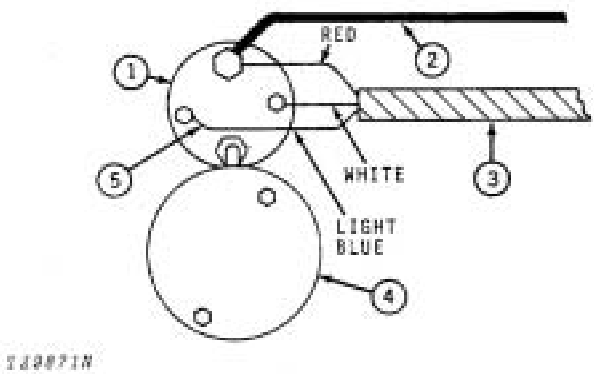
1—Pinion
2—Pinion Stop
3—Feeler Gauge

Fig. 16-Checking Pinion Clearance

4. Push the pinion back towards the commutator end as indicated by the arrow in Fig. 16 to eliminate slack movement.

5. Measure the distance between pinion and pinion stop. The clearance should be between 0.010 inch and 0.140 inch (0.25 and 3.56 mm).

INSTALLATION



1—Solenoid
2—Positive Battery Cable
3—Wire Harness
4—Starting Motor
5—Used on Gasoline Tractors Only

Fig. 17-Solenoid Connections

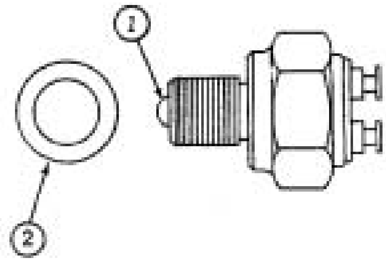
Install starter. Connect wiring harness and positive battery cable (Fig. 17).

Connect battery ground cable.

NEUTRAL START SWITCH

These units are equipped with a neutral start switch. This switch prevents unit from starting with shift lever in any gear.

The switch is mounted on the transmission case near the transmission oil filler cap.



1—Nipple
2—Aluminum Washer

Fig. 18-Neutral Start Switch

The switch is normally open. The switch closes when nipple is depressed, thus completing the current path to starter when starting unit.

Adjustment

Put shift lever in neutral.

Install neutral start switch with a minimum of one washer.

Adjust the switch by adding washers (2, Fig. 18), one at a time, until switch continuity is lost.

IMPORTANT: To insure correct adjustment of the switch, tighten the switch to 20 to 25 lb-ft (28 to 3.5 kg-m) EACH TIME a washer is added or removed during the adjustment procedure.

Continuity is lost when a test light will not light or an ohmmeter indicates an open circuit (no ohmmeter needle movement).

When continuity is lost, remove one washer and tighten switch to 20 to 25 lb-ft (2.8 to 3.5 kg-m).

Move the shift lever in and out of gear several times to insure the neutral start switch is closed only in the neutral or park position.

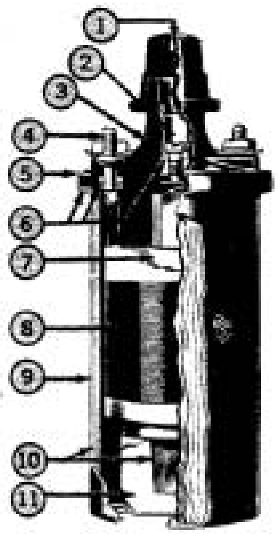
Connect wire leads to switch.

Group 20
IGNITION SYSTEM

GENERAL INFORMATION

The 12-volt ignition circuit on gasoline tractors has a distributor, coil, spark plugs, key switch, resistance wire, starting motor solenoid switch, battery and connecting wires.

Coil

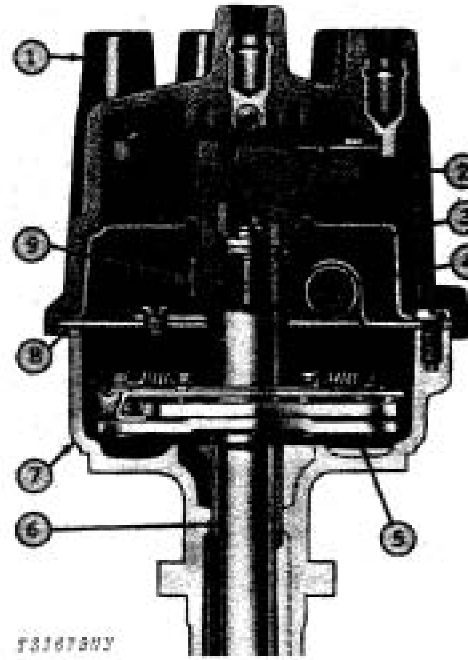


1—Sealing Nipple
2—High Tension Terminal
3—Coil Cap
4—Primary Terminal
5—Spring Washer
6—Sealing Gaskets
7—Secondary Winding
8—Primary Winding
9—Coil Case
10—Lamination
11—Porcelain Insulator

Fig. 1-Ignition Coil

The ignition coil (Fig. 1) is a pulse transformer that steps low primary circuit voltage up to a high secondary voltage of approximately 4,000 to 10,000 volts. The coil may produce up to 25,000 volts.

The primary windings, a few hundred turns of heavy wire, and the secondary windings, many thousand turns of fine wire, surround a soft iron core. A soft iron shell encloses the windings and core. This assembly is inserted into a one-piece steel case, which is filled with oil and hermetically sealed by a coil cap of moulded insulating material. The cap contains the primary and secondary terminals.



1—Cap
2—Rotor
3—Cam
4—Condenser
5—Advance Mechanism
6—Drive Shaft
7—Housing
8—Breaker Plate
9—Breaker Lever

Fig. 2-Distributor

The distributor is mounted on the right-hand side of the engine and is driven by the camshaft at one-half engine speed. The distributor consists of a housing, breaker plate assembly, dust cover, rotor, distributor cap, and a drive shaft to which is attached the centrifugal advance mechanism and breaker cam.

The distributor has three functions. First the breaker cam and contact points close and open the primary circuit, thus causing the ignition coil to produce high-voltage surges. Second, the distributor, geared to engine rotation, times these surges by means of a centrifugal advance mechanism. Third, the distributor directs each high-voltage surge to the proper spark plug.

The breaker plate carries the breaker lever, contact support, and condenser. When the cam is rotated, each cam lobe separates the contact points to produce a high-voltage surge. The condenser, connected across the contact points, functions to produce a quick stop of the primary current and to prevent arcing across the contact points.

Resistance Wire

The ignition resistor is a special resistance wire in the engine wiring harness between the coil and the ignition switch. The resistance wire has a braided insulation covering and a resistance of 2.2 ohms.

When the engine is running, the resistance wire is connected in series with the coil and reduces voltage at the coil. To provide a better spark when starting, the resistance wire is bypassed and battery voltage of approximately 10 volts is applied to the coil. This is accomplished when the starter is operating by current flowing from the "R" solenoid terminal of the starter through the resistor bypass wire to the coil.

Spark Plugs

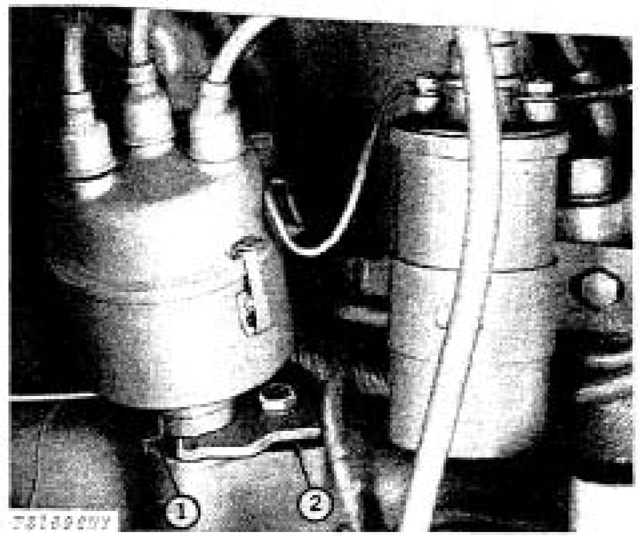
Spark plugs ignite the fuel mixture within the cylinders. The spark plugs are one-piece, 14 mm plugs.

Premature spark plug failure is usually caused by using a plug that is too hot or too cold. A spark plug that is too hot will have severe erosion of the electrodes and blisters at the insulator tip. A spark plug that is too cold will usually have carbon and oil fouling. This is indicated by black carbon accumulation on the insulator. Lead fouling, a tan powdery deposit on the insulator, results from fuel with a high lead content or low engine speed with a light load. The next hotter plug may correct lead fouling.

Spark plugs in their proper heat range will have a grayish tan powdery deposit on the insulator and electrode erosion confined to the spark gap. Spark plugs listed in the tractor parts catalog satisfy normal heat range requirements under average field conditions.

DISTRIBUTOR

REMOVAL

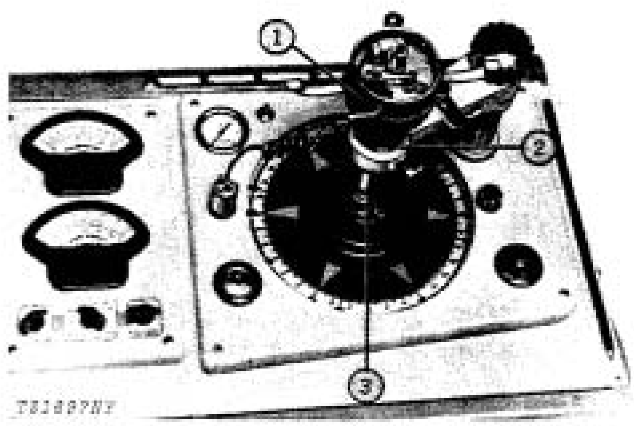


1—Reference Mark 2—Clamp

Fig. 3-Distributor Reference Mark

Place a reference mark on distributor and cylinder block. Remove distributor cap. Turn engine until rotor points to No. 1 cylinder and "TDC" mark on crankshaft pulley is aligned. Remove distributor.

TESTING



1—Primary Insulated Terminal
2—Split Bushing
3—Flexible Drive Coupling

Fig. 4-Distributor Mounted in Syncrograph for Testing

If a syncrograph-type distributor tester is available, mount the distributor on it and follow the manufacturer's instructions to make the following tests.

Contact Point Test

Set syncrograph controls according to manufacturer's instructions. Rotate chuck until contact points are closed. If reading on cam angle meter is not near the "SET" line, clean or replace the point assembly.

Poor Insulation or Leakage Test

Revolve chuck by hand until contact points are open. The cam angle meter reading should be zero. If not, a leak or partial ground exists. Common causes are poor primary terminal insulation, shorted condenser, poor insulation on breaker arm, or short between breaker arm and breaker plate.

Breaker Spring Tension Test

Set syncrograph controls, according to manufacturer's instructions, to show the distributor firing pattern and to drive the distributor shaft clockwise (when viewed from drive end). Operate distributor at 1200 rpm.

If a faint flash of light precedes the regular flash, the breaker spring tension is weak or the breaker arm is binding.

Checking Cam Lobes

With syncrograph set in same manner as for testing breaker spring tension, operate distributor at 950 rpm. All firing positions should be 120 degrees apart. If firing position spacing is 118 degrees or less, the cam is excessively worn and should be replaced.

Checking Centrifugal Advance

Set syncrograph to show firing positions. Operate distributor at 100 rpm and set dial so that one firing position is at 0. Then check distributor advance at the speeds given in chart below.

Rpm	200	400	1200
Advance	0°	4°	15°

Mount distributor so that it is driven directly by syncrograph drive (remove flexible drive). Connect syncrograph lead and operate distributor at 950 rpm. Grasp distributor and shake distributor case. Any variations in firing position will indicate worn bushings or shaft.

Condenser Test

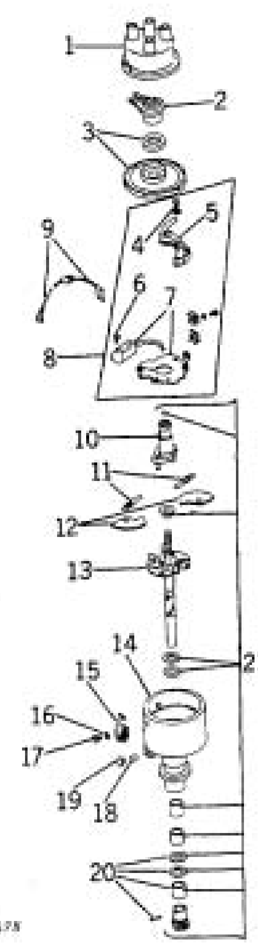
Use a condenser tester to check condenser for each of the following:

1. Breakdown or leakage of insulation.

2. High series resistance of condenser lead and its connections.

3. Capacity of condenser plates, which should be 0.18 to 0.21 microfarads.

REPAIR



1—Cap
2—Rotor
3—Dust Cover, with Felt Seal
4—Machine Screw (No. 8 x 3/16")
5—Breaker Point
6—Machine Screw (No. 6 x 5/32")
7—Condenser
8—Breaker Plate Assembly
9—Primary Lead
10—Cam and Stop Plate
11—Governor Weight Spring
12—Weight (2 used)
13—Drive Shaft
14—Housing
15—Cap Clamp (2 used)
16—Lock Washer (2 used)
17—Machine Screw (No. 8 x 5/16") (2 used)
18—Felt Wick
19—Oiler Plug
20—Gear Replacement Kit
21—Shaft Bearings, Washers, and Spacers Kit

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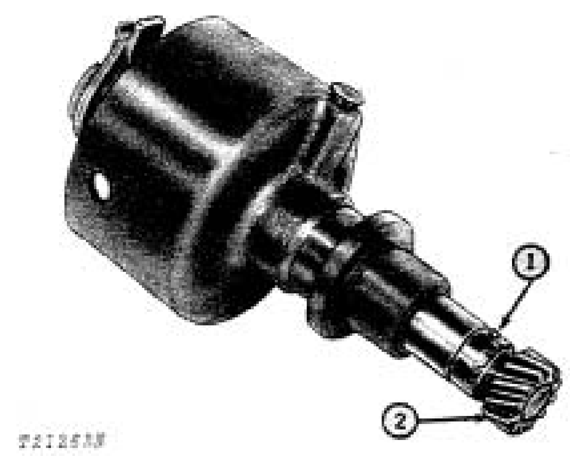
Fig. 5-Distributor

Disassembly

Disassemble distributor only as far as necessary to repair or replace defective parts (Fig. 5).

Remove breaker plate assembly with points and condenser. Detach point assembly and condenser. Push grommet from outside to inside of housing and remove distributor wire.



1—Spring Pin 2—Drive Gear

Fig. 6-Rotor Position Marked on Shaft and Drive Gear

Mark rotor position on both the shaft and drive gear (Fig. 6). Drive spring pin from drive gear. Remove gear, thrust washers, shaft with cam, and advance mechanism.

Disassemble advance mechanism by removing cam retaining ring, weight springs, cam, cam spacer, and advance weights.

Clean and inspect distributor cap, rotor, and dust cover. NEVER clean with any type of degreasing compound. Check rotor tip and terminals inside of cap for excessive burning away of material. Too great a clearance will place a greater strain on the coil.

Bushing Replacement

Remove breaker plate assembly. Push grommet from outside to inside and remove distributor wire. Mark rotor position on the shaft and the gear (Fig. 6). Drive spring pin from gear. Remove gear, thrust washers, and shaft with cam and advance mechanism.

Remove old bushings and carefully install new ones 0.094 inch [2.39 mm] below the housing surface. Use an arbor with a pilot that is 0.5001 to 0.5003 inch [12.703 to 12.708 mm] in diameter and 1 inch [25.4 mm] long.

Remove grease hole plug and drill lubrication hole in top bushing. Clean and deburr bushing. Pack new wick with cam lubricant or similar high temperature lubricant. Install plug.

Check advance mechanism for wear. A worn camshaft gear can cause excessive wear on advance mechanism. If cam was removed, lubricate shaft and bearing surface of cam with cam lubricant or high temperature lubricant.

Drive Gear Replacement

When installing a new drive gear, place gear on shaft and finish drilling spring pin hole with a 1/8-inch [3.175 mm] drill.

Contact Points

Replace breaker plate assembly if the pivot post is loose or worn.

FOS

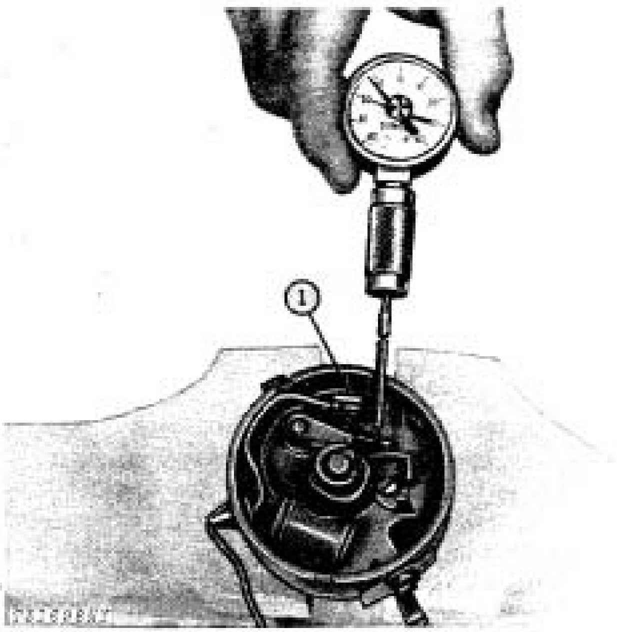
Check contact point condition. See Chapter 6 of FOS Manual 20—ELECTRICAL SYSTEMS for point servicing information. For emergency reconditioning of points, hone contact surfaces and clean the contacts.

Align the points and set point gap to 0.018 to 0.022 inch [0.46 to 0.56 mm] (96° to 102° cam dwell).

Assembly

Install cam spacer on shaft and weight plate assembly. Fill upper housing bearing lubrication hole and lubricate bearing bore of cam and the advance weights with a cam lubricant or other suitable high-temperature grease. Install advance springs, weights, cam and cam retaining ring.

Lubricate the drive shaft with SAE 20W oil and place the outer and inner thrust washers on drive shaft. Install drive shaft in distributor housing. Place inner and outer thrust washers, spacer, and drive gear on distributor shaft. Install spring pin with one end of spring pin exposed (0.060 inch [1.52 mm] max.) to indicate position of rotor. Distributor shaft end play is 0.002 to 0.010 inch [0.05 to 0.25 mm].



1—Spring Attaching Screw

Fig. 7-Checking Breaker Spring Tension

Install breaker plate, distributor wire, condenser, and point assembly. Check point alignment. Bend only the stationary contact to align contacts. Set the contact gap to 0.020 inch [0.51 mm]. Check breaker spring tension with a scale and pull on a line perpendicular to the contact face. The tension should be 17 to 22 ounces [481.95 to 623.70 g] at the center of contact or 19 to 24 ounces [538.65 to 680.40 g] when measured beside the contact (Fig. 7). Spring may be adjusted by sliding in or out on the attaching screw or by bending the spring.

The contacts should be cleaned with a few drops of lighter fluid on a strip of lint-free cloth. Then pull a dry strip through points to remove residue. Observe caution when using lighter fluid. If present, oxide on the points can be removed with a cloth soaked in water.

Apply a trace of cam lubricant to the cam. DO NOT OVERLUBRICATE.

TEST AFTER ASSEMBLY

Mount distributor in syncrograph, using flexible drive connection. Connect lead to distributor terminal. Turn switch to "CAM ANGLE." With contact points closed, adjust "SET" knob until pointer is at "SET" on meter dial.

Operate distributor at 950 rpm. Cam angle should be 96 to 102 degrees. Do not set contact gap outside of limits of 0.018 to 0.022 inch [0.46 to 0.56 mm] to obtain specified cam dwell. Replace cam if difficulty is encountered.

Correct point opening can be set with a feeler gauge only when points are new or in good condition, because of the irregularity of worn points.

If centrifugal-advance mechanism was disassembled, recheck the advance on the syncrograph as previously discussed.

If after weights are clean and free of binds, it is necessary to adjust the distributor advance, bend the outer spring support. The light spring controls distributor advance below 400 rpm. The heavy spring controls most of the distributor advance between 400 and 1200 rpm.

INSTALLATION

To provide a good electrical ground, the distributor mounting must be clean. With rotor and housing in same position as when removed, install distributor. Line up reference marks scribed during removal (Fig. 3). To prevent seizing of bearing, make sure that distributor is all the way down and that the drive gear is properly meshed with the camshaft.

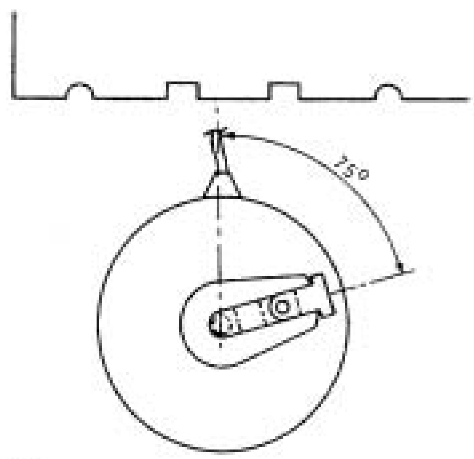


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Fig. 8-Indexing Distributor

If in doubt about proper distributor position, use the following procedure. With No. 1 cylinder at top center on compression stroke, position rotor arm 75 degrees clockwise (view from rotor end of distributor) from primary lead (Fig. 8). Install distributor so that primary lead points toward the engine and is perpendicular to center line of engine. When correctly engaged, the rotor arm will be approximately 50 degrees from the primary lead.

Install and tighten distributor clamp so that engine may be run. Connect coil-to-distributor primary lead. Install dust cover, rotor, and distributor cap. Spark plug cables are installed in distributor cap in engine firing order (1-2-3).

TIMING THE DISTRIBUTOR

See Section 70, Group 15.

COIL

TESTING

Check top of coil for carbon tracks or cracks which can cause current leakage, resulting in poor performance. Check for clean, tight connections.

Test the coil in a coil tester. Test the coil when it is hot and also when cold (coil usually takes 15 minutes to heat up). Coil primary current draw, is 4.2 to 4.8 amps at 6.0 volts.

When installing the coil, connect the distributor primary lead to the negative (−) coil primary terminal.

SPARK PLUGS

REMOVAL

Blow dirt and trash away from spark plugs. Be sure to protect your eyes from flying particles.

Pull spark plug cables from spark plugs. Grip cable at terminal not on the cable. Use a suitable spark plug socket (deep-well type) to remove the spark plugs and gaskets.

REPAIR

Discard plugs that have cracked insulators, badly eroded electrodes or are otherwise defective.

If inspection shows cables have deteriorated insulation or broken strands, replace with new cables.

Cleaning

If spark plugs are suitable for further use, clean them. If spark plug condition is questionable, replace plugs. Excessive fuel consumption in an engine with old, dirty plugs, will soon exceed the cost of new plugs.

After cleaning spark plugs, brush threads with a wire brush or a wire brush buffing wheel.

To remove insulating deposits and erosion from the electrodes, file them with a small finecut contact file. The electrodes should have flat, parallel surfaces.

Setting Spark Gap

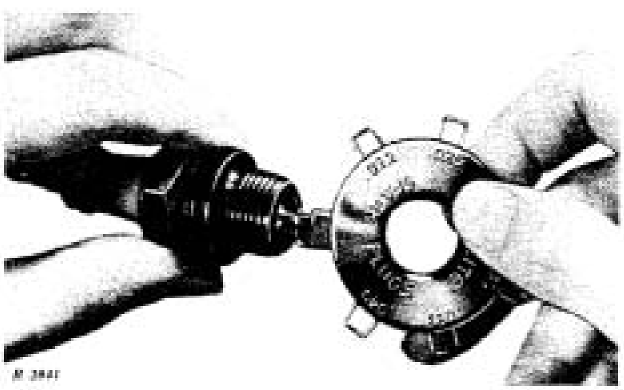


Fig. 9-Setting Gap Clearance

Using a wire-type gauge, set spark plug gap by bending the outer or grounded electrode only (Fig. 9). The spark plug gap should measure 0.025 inch [0.64 mm]. Test plug in a spark plug tester to compare its efficiency with a new plug.

INSTALLATION

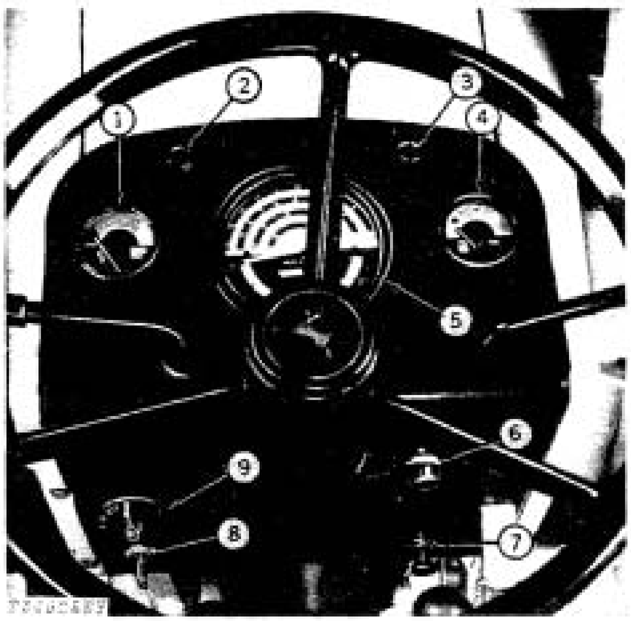
Thoroughly clean the spark plug mounting surface. Any foreign material on this surface retards flow of spark plug heat, makes a poor electrical ground and compression seal.

Install and tighten plugs to 35 lb-ft torque [4.84 kg-m]. Push spark plug cable boots all the way on spark plugs.

Group 25
GAUGES AND SWITCHES

GENERAL INFORMATION

Refer to Fig. 7, Section 70, Group 15 for testing and wiring schematics for the gauges and switches.



1—Engine water Temperature Gauge
2—Alternator Indicator Lamp
3—Engine Oil Pressure Indicator Lamp
4—Fuel Gauge
5—Tachometer
6—Horn Switch
7—Cigar Lighter
8—Key Switch
9—Light Switch

Fig. 1-Instrument Panel

Alternator Indicator Lamp

The alternator indicator lamp will light when the key switch is in the "ACC" or "IGN" position. When the key is turned to the "ST" position and the engine cranks the lamp will go out. If the lamp comes on when the engine is running, the alternator is not charging. In this case, stop the engine and troubleshoot the electrical system.

The replacement bulb trade number is 1895R.

Engine Oil Pressure Indicator Lamp

The engine oil pressure indicator lamp will light when the key switch is in the "ACC" or "IGN" position. When the key is turned to the "ST" position and the engine starts the lamp will go out and should remain out. If the lamp comes on while the engine is running, shut off the engine and diagnose the trouble.

The replacement bulb trade number is 1895R.

Engine Oil Pressure Switch

The engine oil pressure switch is located at the rear of the engine on the right-hand side. The switch will close at 5.5 to 10.5 psi.

Cigar Lighter

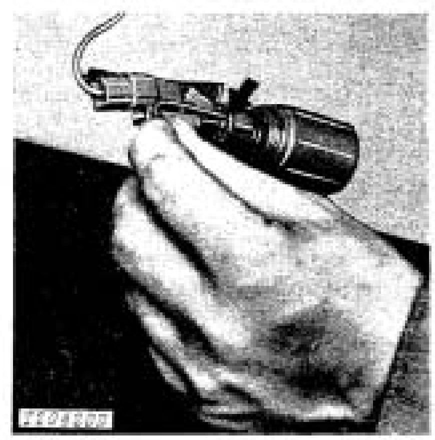


Fig. 2-Resetting Cigar Lighter Circuit Breaker

If the cigar lighter fails to operate, its circuit breaker may be open and must be reset. Lift up cowl door for access to back of instrument panel. Then insert a wire in the small hole at the rear of the lighter (Fig. 2).

Key Switch

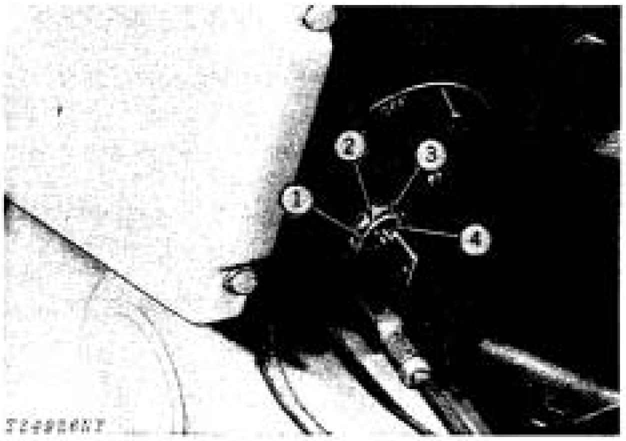


Fig. 3-Key Switch Position

The key switch is a sealed unit and cannot be repaired.

In position (1) the "ACC" terminals are energized.

In position (2) the key switch is in the "OFF" position and the key can be removed.

In position (3) the "IGN" and "ACC" terminals are energized.

In position (4) the "IGN" and "ST" terminals are energized and the "G" terminal is momentarily grounded. A spring in the switch will automatically return the switch back to position (3).

Light Switch

The light switch "BAT" terminal is energized by the key switch "ACC" terminal. To bypass the key switch remove the purple wire from the "BAT" terminal and install the unused red wire coming off the circuit breaker.

In "W" position the "BAT" and "W" terminals are energized. In this position the warning lamps will be lit.

In "F" position the "BAT", "HD", and "FL" terminals are energized. In this position the front headlights are lit and the rear combination flood and taillight is lit as a white flood light.

In "H" position the "BAT", "HD", "TL" and "W" terminals are energized. In this position the headlights are on bright, the warning lamps are lit, and the rear combination flood and taillight is lit as a red taillight.

In "H'" position the same terminals are energized and the same lights are lit as in "H" position. The only difference is that the "HD" terminal is energized through a one ohm resistor and the front headlights are dimmer.

Lights

Failure of lights to burn may be caused by a burned out unit, broken wire, a disconnected wire, switch failure or a tripped circuit breaker if light switch is wired to circuit breaker.

The replacement lamp trade No. for the front headlights is 4411.

The replacement lamp trade No. for the rear combination flood and taillight light is 4428 and the bulb No. is 1003.

The replacement bulb trade No. for the warning lamps is 1156.

Flasher

The flasher unit for the warning lamps is located inside the instrument panel. It is energized by the light switch "W" terminal.

Circuit Breaker

The wiring for the electrical system is protected by a 20 amp circuit breaker.

If the circuit breaker opens because of a short circuit or overloading the electrical system will fail. When this occurs, turn off the key switch, and wait one minute. The circuit breaker will rest itself.

Fuel Gauge

The fuel gauge is controlled by a sending unit located in the fuel tank.

The fuel gauge is energized by the "ACC" terminal of the key switch through the alternator and engine oil pressure indicator lamps.

Horn Switch

The horn switch is wired to the hot terminal of the circuit breaker.

Horns

For information about the type "C" air tone horn, see FOS Manual "ELECTRICAL SYSTEMS".

DASH REMOVAL

Remove left and right-hand cowl panels and door.

Remove batteries. See "Battery Removal" in Group 5.

Disconnect speed control linkage from right and left side of the dash. Disconnect reverser linkage.

Disconnect main wire harness from all connections on the engine (main wire harness will have to come off with dash). Disconnect all connections at the light switch. Tag all wires for easier installation.

Remove transmission case shield and disconnect wires from start-safety switch.

Remove all attaching screws and remove dash.

GAUGE AND SWITCH REMOVAL

Remove left-hand cowl panel.

Remove batteries. See "Battery Removal" in Group 5 of this section.

Disconnect wires necessary to remove defective gauge or switch.

DASH INSTALLATION

Use reverse procedure of removal. Refer to Section 70, Group 15 for wiring schematic if needed.

GAUGE AND SWITCH INSTALLATION

Install new gauge or switch. Connect wires removed. Refer to Section 70, Group 15 for wiring schematic if needed.

Install batteries. See "Battery Installation" in Group 5 of this section.

Install left hand cowl panel.

Group 30
SPECIFICATIONS AND SPECIAL TOOLS
BATTERIES

SPECIFICATIONS AND TORQUE VALUES

Battery ground .... Negative
Full charge specific gravity (corrected for 80°F [26.7°C] electrode temperature 1.260
Maximum variation between cells during specific gravity test (specific gravity points) 0.050
High-rate discharge test (minimum reading) .... 9.0 volts

When replacing the battery(s) use the John Deere battery or its equivalent shown in the following chart:

Volts	John Deere Part Number	BCI Group	Cold Cranking AMPS 0°F [−17.8°C]	Cold Cranking AMPS −20°F [−28.9°C]	Reserve Capacity (Minutes at 25 amps)
12	AR67338	24	370	300	106

SPECIAL TOOLS

Convenience Tools

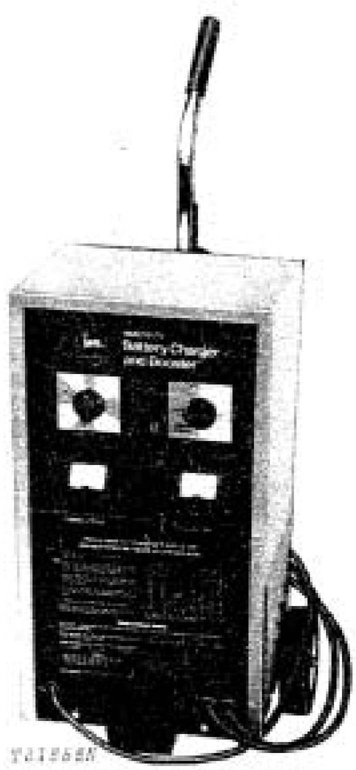
Tool	Tool Number	Use
	TY-1337 (10 amp)* TY-1338 (15 amp)* TY-1339 (30 amp)* TY-1340 (100 amp)*	Charge battery and booster to start engine.

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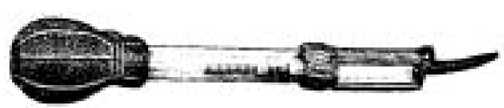
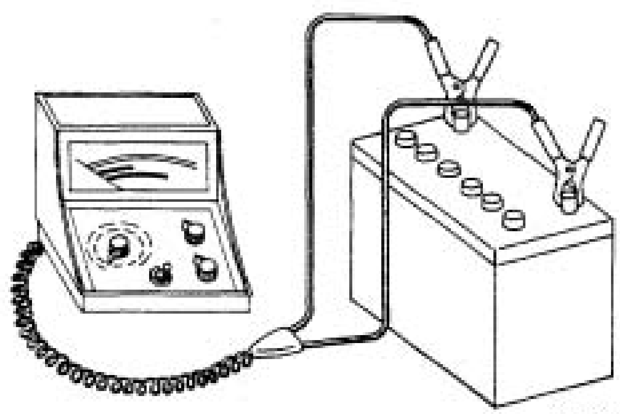
Fig. 1-Battery Charger

*Order from your John Deere Dealer

BATTERIES

SPECIAL TOOLS—Continued

Convenience Tools—Continued

Tool	Tool Number	Use
 Fig. 2-Hydrometer	-----	Check specific gravity
 Fig. 3-Battery Tester	D-24001 MO	To check battery internal condition

CHARGING SYSTEM

SPECIFICATIONS AND TORQUE VALUES

Alternator

Rating . . . . 12 volts, 35 amps
Ground . . . . Negative
Stator winding . . . . Wye

1 - Brush Minimum length
beyond holder . . . . 1/4-inch (6.35 mm)

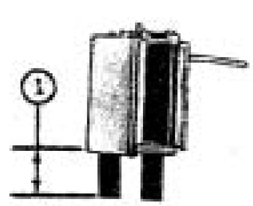


Fig. 4-Brush Length

CHARGING SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

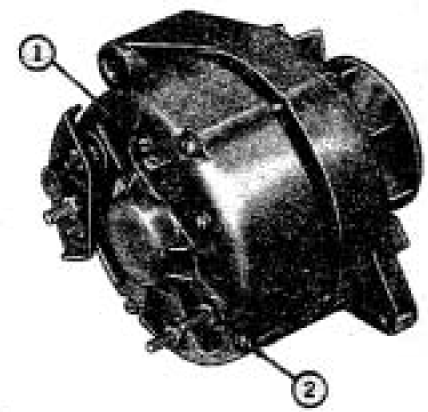


Fig. 5-Alternator Brush Screws and Through Bolts

1 - Brush screws ....20 to 30 lb-in [0.230 to 0.346 kg-m]
2 - Through bolts ....50 to 60 lb-in [0.576 to 0.691 kg-m]

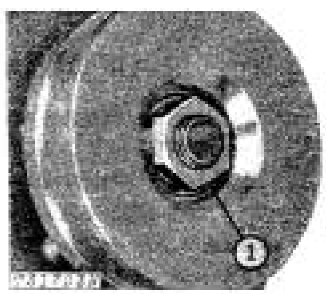


Fig. 6-Alternator Pulley Nut

1 - Pulley nut .... 40 to 50 lb-ft [5.530 to 6.913 kg-m]

SPECIAL TOOLS

Essential Tools

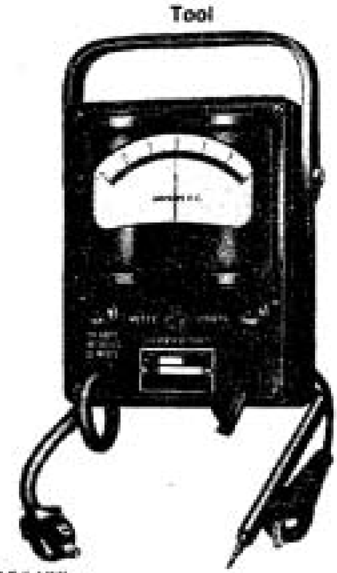
Tool	Tool Number	Use
	------	To test diodes

Fig. 7-Alternator Diode Tester

CHARGING SYSTEM

SPECIAL TOOLS—Continued

Essential Tools—Continued

Tool | **Tool Number** | **Use**

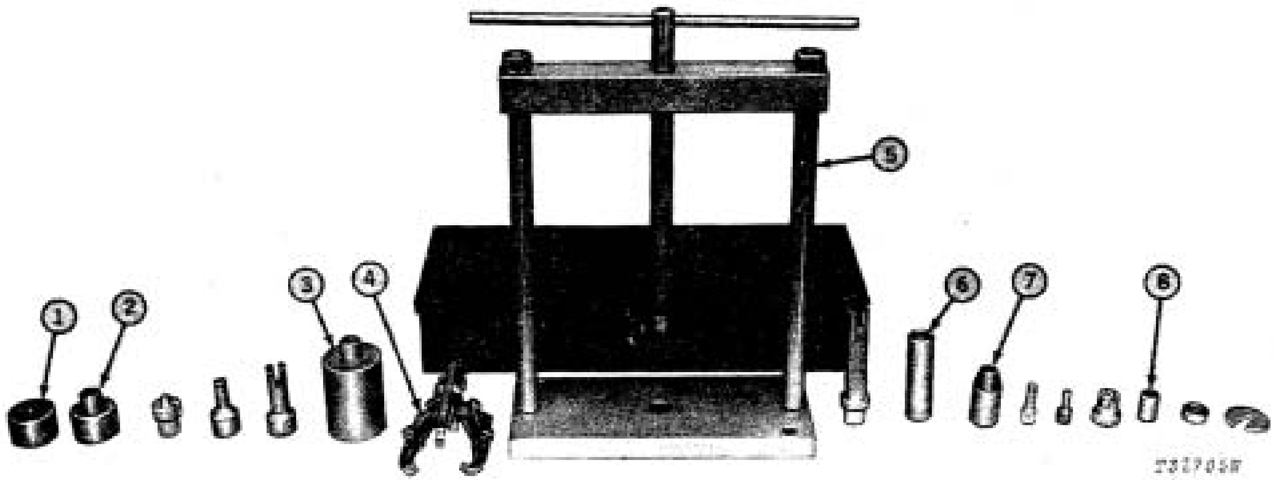


Fig. 8-A200JD Alternator Service Tool Set

Tool Number	Use
1-A-203*	To install front bearing
2-A-208*	To install rear bearing To install front housing
3-A-207*	To install front bearing
4-A-216*	To remove rear bearing
5-A-201*	To install rear bearing
6-A-209*	To install front housing
7-A-206*	To install rear bearing
8-A-205*	To install front housing

Convenience Tools

Tool Number	Use
D-19001 TT	To test brushes, rotor, stator, and diodes.

Fig. 9-Voltmeter, Ohmmeter, Ammeter

Tools are part of A200JD Alternator Service Tool Set and cannot be purchased individually.

STARTING SYSTEM

SPECIFICATIONS AND TORQUE VALUES

No Load Test

Motor No.	Test Volts	Min. Amps	Max. Amps	Min. RPM	Max. RPM
1108319 (Gasoline)	9.0	55*	80*	3500	6000
1107871 (Diesel)	9.0	40*	140*	8000	13000

Includes solenoid.

Solenoid Test

Pull-In (current draw at 5 volts) .... 13 to 15.5 amps
Hold-In (current draw at 10.0 volts) .... 14.5 to 16.5 amps

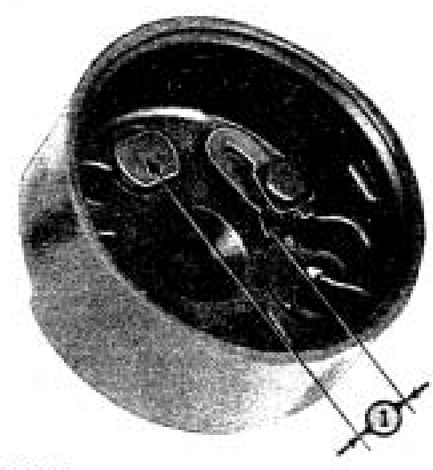


Fig. 10-Solenoid "R" Terminal Contact Height

Solenoid

1 - "R" terminal contact height ..... 1/16 to 3/32 in. [0.792 to 2.383 mm]

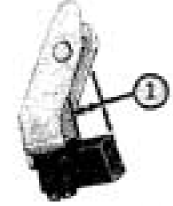


Fig. 11-Brush Length

Starting Motor - Model No. 1108319 and Model No. 1107871

1 - Brush minimum length beyond holder ...5/16 in. [7.94 mm]

STARTING SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

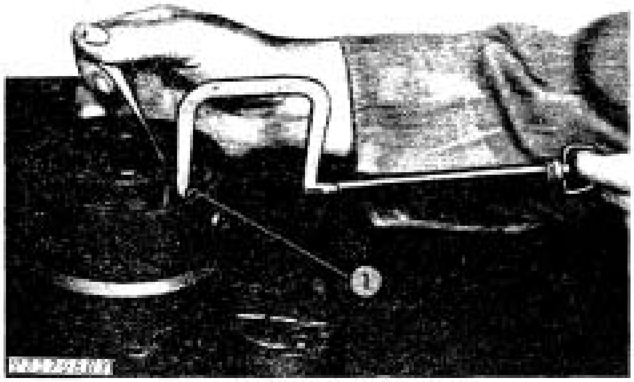


Fig. 12-Brush Spring Tension

1 - Brush spring minimum tension .... 35 oz.
[992.25 g]

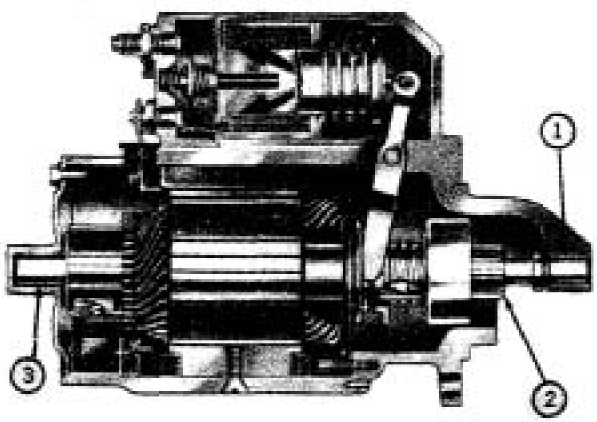


Fig. 13-Starting Motor

1 - Drive housing bushing
I.D. .... 0.4990 to 0.5010 in.
[12.674 to 12.725 mm]
Wear tolerance 0.511
[12.979 mm]
Oil clearance .... 0.0020 to 0.0050 in.
[0.050 to 0.127 mm]
Wear tolerance .... 0.0170 in.
[0.431 mm]

2 - Overrunning clutch bushing
I.D. .... 0.5620 to 0.5630 in.
[14.274 to 14.300 mm]
Wear tolerance .... 0.5740 in.
[14.579 mm]

3 - Commutator end frame bushing
I.D. .... 0.5625 to 0.5635 in.
[14.288 to 14.312 mm]
Wear tolerance .... 0.5730 in.
[14.554 mm]
Oil clearance .... 0.0020 to 0.0050 in.
[0.050 to 0.127 mm]
Wear tolerance .... 0.0160 in.
[0.406 mm]

Neutral Start Switch

Tighten to .... 20 to 25 lb-ft
(2.8 to 3.5 kg-m)

STARTING SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

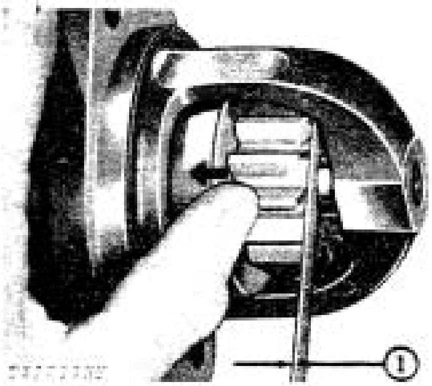
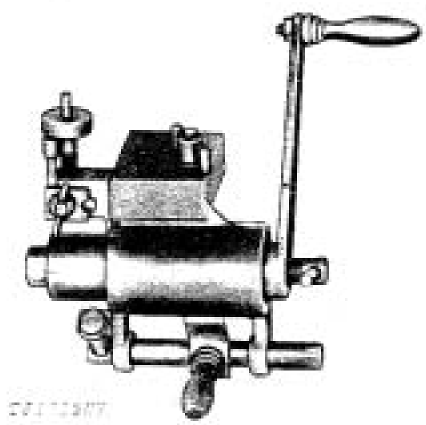
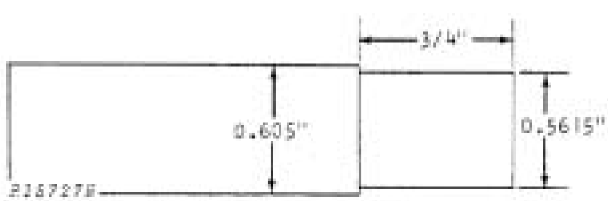


Fig. 14-Pinion Clearance

1 - Pinion clearance ....0.010 to 0.140 in. [0.25 to 3.56 mm]

SPECIAL TOOLS

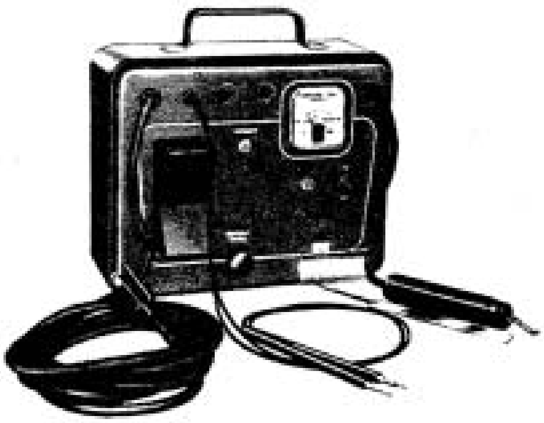
Convenience Tools

Tool	Tool Number	Use
 Fig. 15-Armature Commutator Turning and Undercutting Tool	------	To undercut armature and commutator
 Fig. 16-Pre-Lubricated Bushing Arbor	------	To install overrunning clutch bushings

STARTING SYSTEM

SPECIAL TOOLS—Continued

Convenience Tools—Cont.

Tool	Tool Number	Use
 *Fig. 17-Armature Tester*	------	To test armature for shorts, opens and grounds
 *Fig. 18-Spring Tension Gauge*	------	To check brush spring tension

IGNITION SYSTEM

SPECIFICATIONS AND TORQUE VALUES

Coil

Primary winding current draw....................4.2 to 4.8 amps at 6 volts

Distributor

Firing position
Spacing....................118.2 to 120°
Wear limit....................118°
Cam angle....................96 to 102°
Centrifugal advance
200 rpm....................0°
400 rpm....................4°
1200 rpm....................15°
Condenser capacity....................0.18 to 0.21 Microfarads

1 - Distributor shaft end play.......0.002 to 0.010 in. [0.05 to 0.25 mm]
2 - Distributor shaft O.D...........0.4985 to 0.4990 in. [11.662 to 12.675 mm]

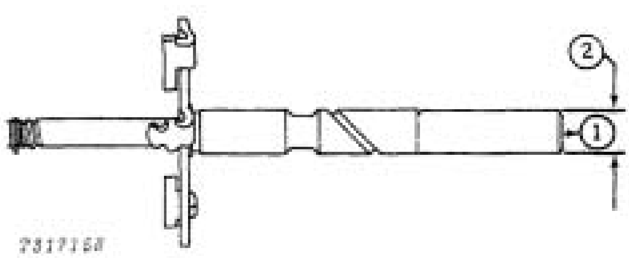


Fig. 19-Distributor Shaft

1 - Breaker spring tension
Beside contact....................19 to 24 oz. [522.65 to 680.46 g]
Center of contact....................17 to 22 oz. [465.95 to 623.76 g]

2 - Distributor point
Gap....................0.018 to 0.022 in. [0.46 to 0.56 mm]
Pitting maximum depth....................0.020 in. [0.51 mm]

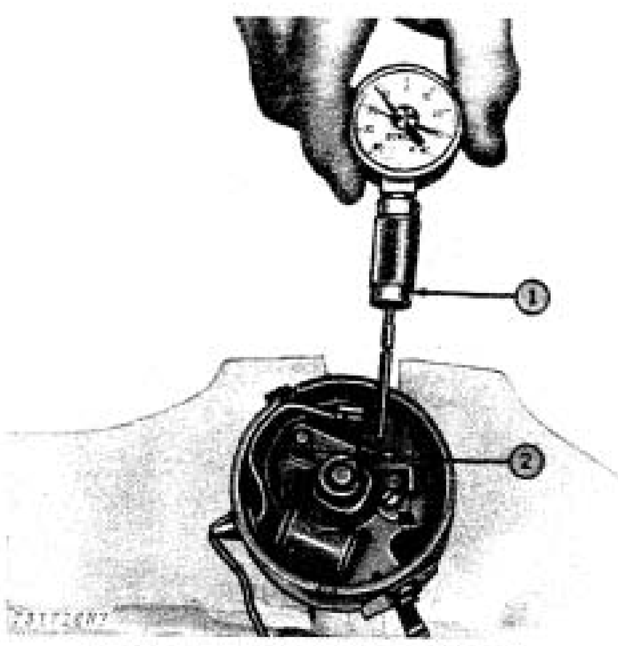


Fig. 20-Breaker Spring Tension and Point Gap

IGNITION SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

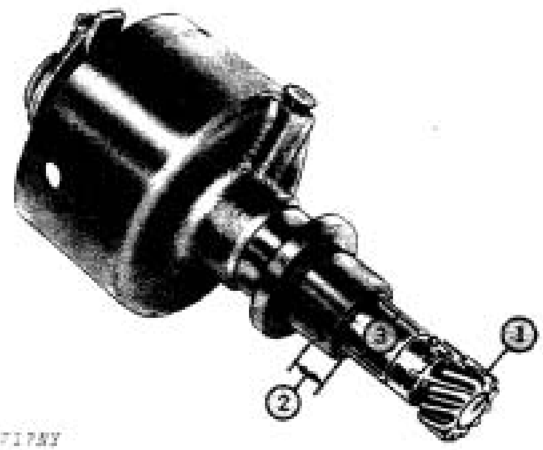


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Fig. 21-Spring Pin and Bushing

1 - Distance spring pin protrudes from drive gear .... 0.060 in. max. [1.52 mm]

2 - Depth to press bushings into housing .... 0.0940 in. [2.388 mm]

3 - I.D. .... 0.5003 to 0.5008 in. [12.708 to 12.720 mm]
Wear tolerance .... 0.5030 in. [12.775 mm]

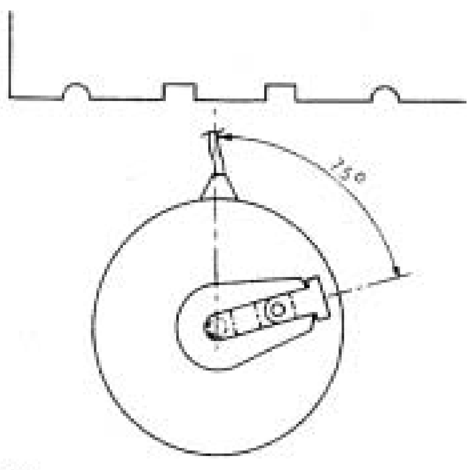

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Fig. 22-Rotor and Primary Lead Position Before Installation

1 - Rotor and primary lead position before installation .... 75°

IGNITION SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

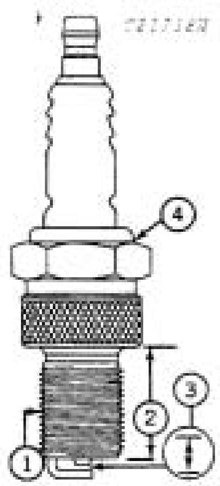


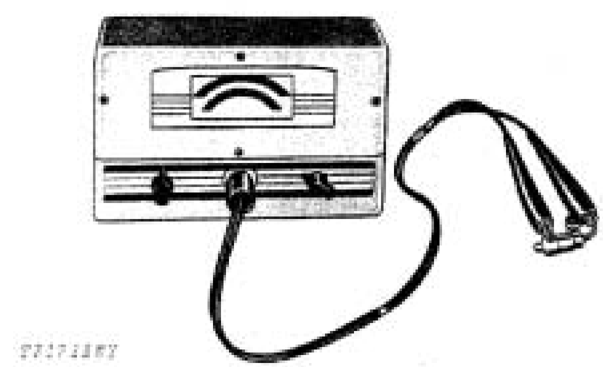
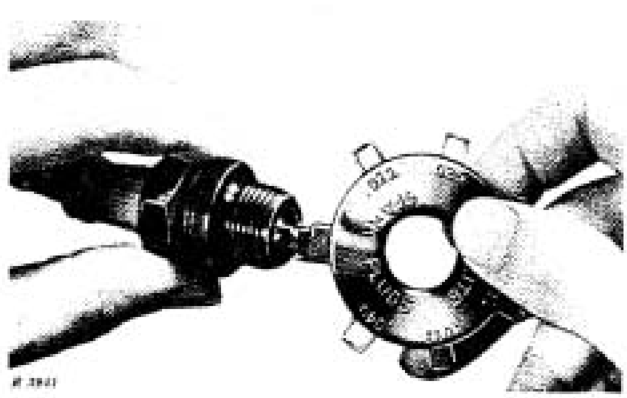
Fig. 23-Spark Plug

Spark Plugs

1 - Thread .... 14 mm
2 - Reach .... 0.750 in. [19.05 mm]
3 - Gap .... 0.025 in. [0.64 mm]
4 - Torque .... 35 lb-ft. [4.84 kg-m]

SPECIAL TOOLS

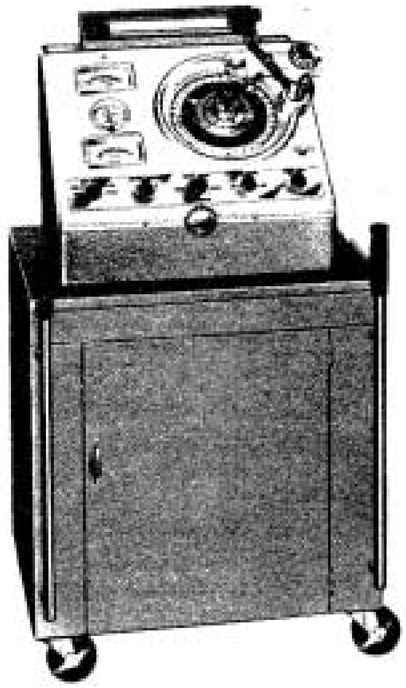
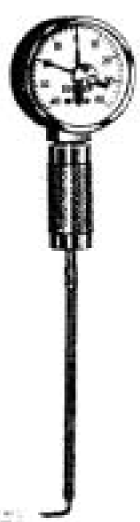
Convenience Tools

Tool	Tool Number	Use
 Fig. 24-Ignition Coil and Condenser Tester	------	To test coil current draw and condenser capacity
 Fig. 25-Spark Plug Gap Gauge	------	To check spark plug gap

IGNITION SYSTEM

SPECIAL TOOLS—Continued

Convenience Tools—Cont.

Tool	Tool Number	Use
 Fig. 26-Distributor Tester	-------	To test distributor cam dwell angle and centrifugal advance
 Fig. 27-Spring Tension Gauge	------	To check breaker spring tension

IGNITION SYSTEM

SPECIAL TOOLS—Continued

Convenience Tools—Cont.

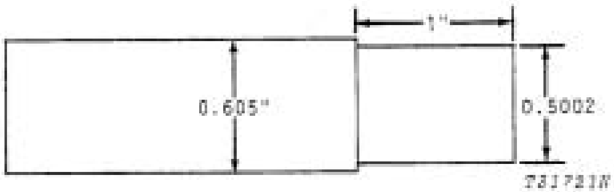
Tool	Tool Number	Use
	------	To press bushings into distributor housing

Fig. 28-Bushing Arbor

GAUGES AND SWITCHES

SPECIFICATIONS AND TORQUE VALUES

Bulbs
- Indicator lamps 1895R
- Front lights 4411
- Rear combination light
  - Sealed beam 4428
  - Bulb 1003
- Warning lamps 1156

Circuit breaker .... 20 amps
Reset time .... 1 minute

Engine oil pressure switch .... closes below 5.5 to 10.5 psi

Section 40
POWER TRAIN

CONTENTS OF THIS SECTION

Group 5
CLUTCH ASSEMBLIES

GENERAL INFORMATION

Single Stage Clutch

A single-stage clutch is used on all tractors except those equipped with continuous-running PTO or standard transmission.

The assembly is attached to the rear of the engine flywheel and consists of a single spring-loaded, dry disk-type clutch with friction facings riveted or bonded to either side of the driven disk.

Dual Stage Clutch

A dual stage clutch is used when unit is equipped with continuous-running PTO or standard transmission. The assembly contains a single stage engine clutch mounted against the flywheel and a single stage PTO clutch mounted in tandem with the engine clutch. Each consists of a dry disk-type clutch with friction facings bonded or riveted to the driven disks. When in engaged position, the engine clutch friction facings contact the rear surface of flywheel and clutch plate. PTO clutch facings contact the power-shaft clutch plate and clutch cover.

The engine clutch or front clutch supplies engine power to the transmission through the transmission clutch shaft. PTO clutch or rear clutch supplies power to the power take-off.

CLUTCH AND CONTROLS

Removal

Disconnect battery ground strap. Drain oil from transmission.

Disconnect all connections between clutch housing and engine as outlined under "ENGINE REMOVAL," Section 20, Group 5.

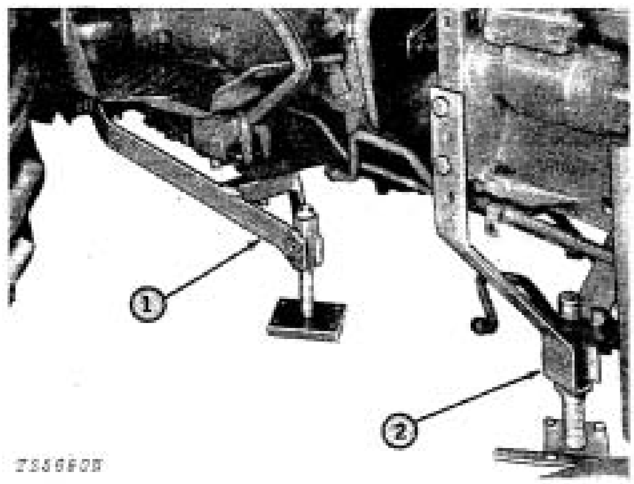
Disconnect main hydraulic pump pressure line at tee or elbow on right side of transmission case.

Remove retainer from main pump inlet line and reservoir return line at front of clutch housing.

NOTE: Do not lose check valve in end of main pump inlet line when pulling line.

Disconnect power steering pressure line from steering valve.

Insert wooden blocks between front axle and front end support to keep tractor from tipping.



1—JDG-2A Support Stand **2—JDG-2K Support Stand**

Fig. 1-Removing Engine with Front End Support From Clutch Housing

Modify JDG-2K tractor splitting stand by slotting one hole in each side of stand so that two cap screws may be installed in each side of flywheel housing. Position stand on engine flywheel housing pads as shown in Fig. 1.

Support rear half of tractor with JDG-2A splitting stand and remove engine to clutch housing attaching cap screws and roll engine with front end support away from clutch housing as shown in Fig. 1.

Remove right and left footrest from tractor. Also remove clutch return spring.

Remove transmission case shield.

Disconnect rear wiring harness and starter safety switch lead.

,Disconnect brake lines from brake valve.

Remove transmission shift cover, to remove one shift cover attaching cap screw (see inset in Fig. 2).

Remove transmission-hydraulic oil filter. Remove attaching cap screws and separate clutch housing from transmission.

Do not lose O-ring packings in clutch housing mounting surface.

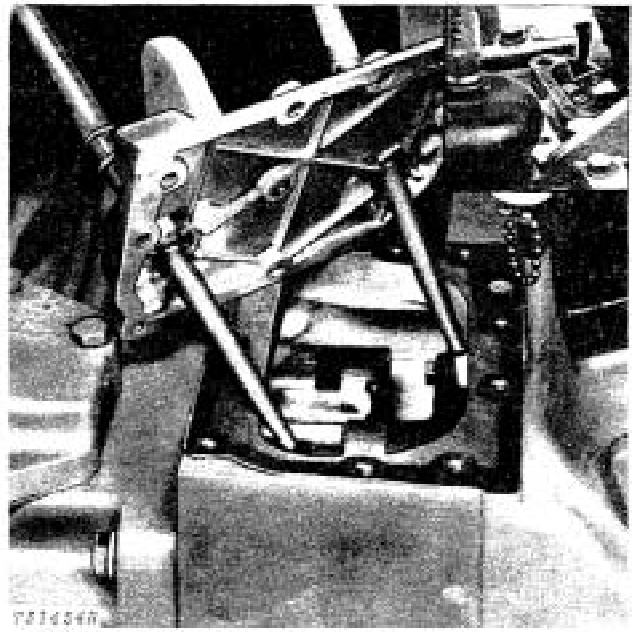
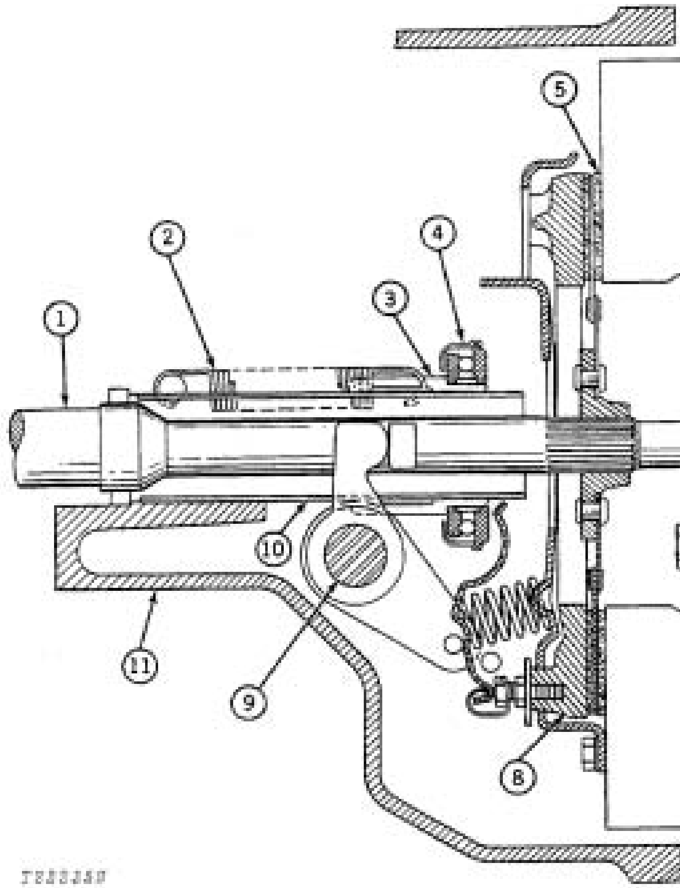


Fig. 2-Removing Shift Levers

SINGLE STAGE CLUTCH



1—Drive Shaft
2—Return Spring
3—Throw-Out Bearing Carrier
4—Throw-Out Bearing
5—Driven Disk
6—Flywheel
7—Pilot Bearing
8—Pressure Plate
9—Clutch Shaft with Fork and Arm
10—Carrier Sleeve
11—Clutch Housing

Fig. 3-Clutch Assembly (Single Stage), Collar Shift

Repair

Refer to Figs. 4, 5 and 6 for identification of parts and proceed as follows.

Remove pressure plate attaching cap screws and lift pressure plate and driven disk from flywheel.

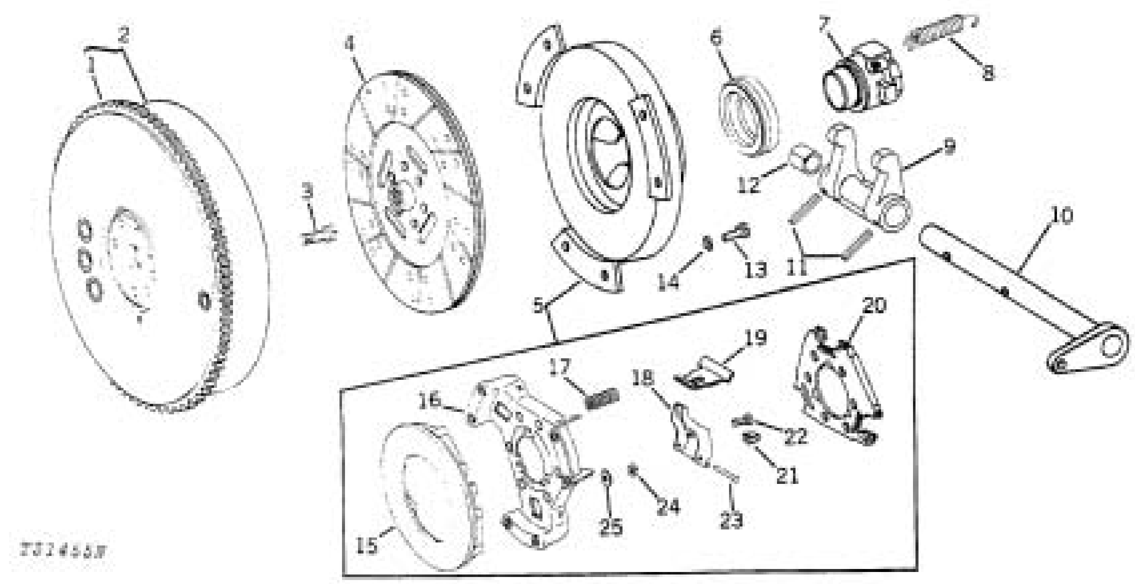
Do not immerse clutch disk in any type of cleaning solution as disk will tend to glaze.

Place flywheel on a bench and install pressure plate. Depress the inner ends of the release levers as far as possible without forcing against bracket. Do this by placing the flywheel on a hydraulic press and applying the load to the levers through a steel plate.

Loosen adjusting screw lock nuts. Back out the three screws from pressure plate and remove return clips.

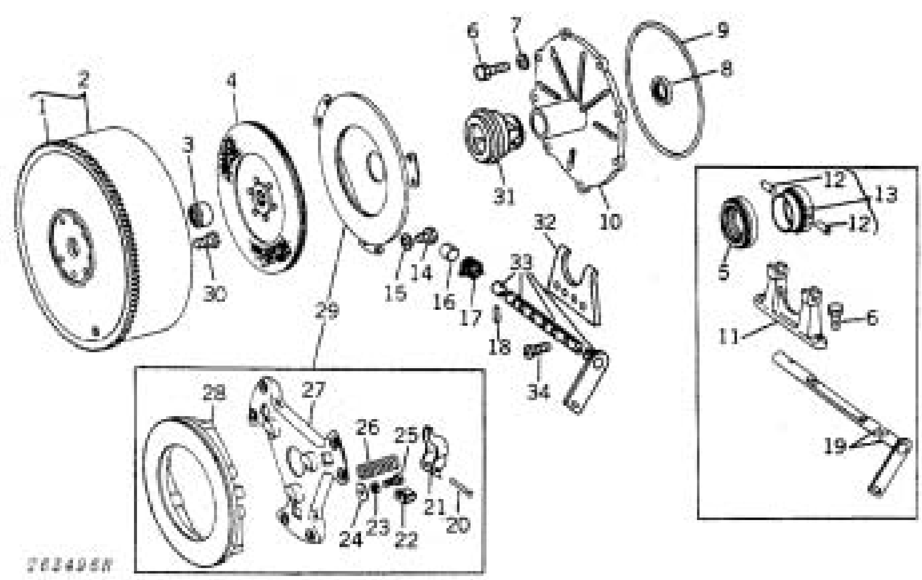
Release assembly by gradually releasing load on press. The clutch may then be disassembled for inspection.

To separate release levers from bracket, first grind off peened ends of pivot pins.



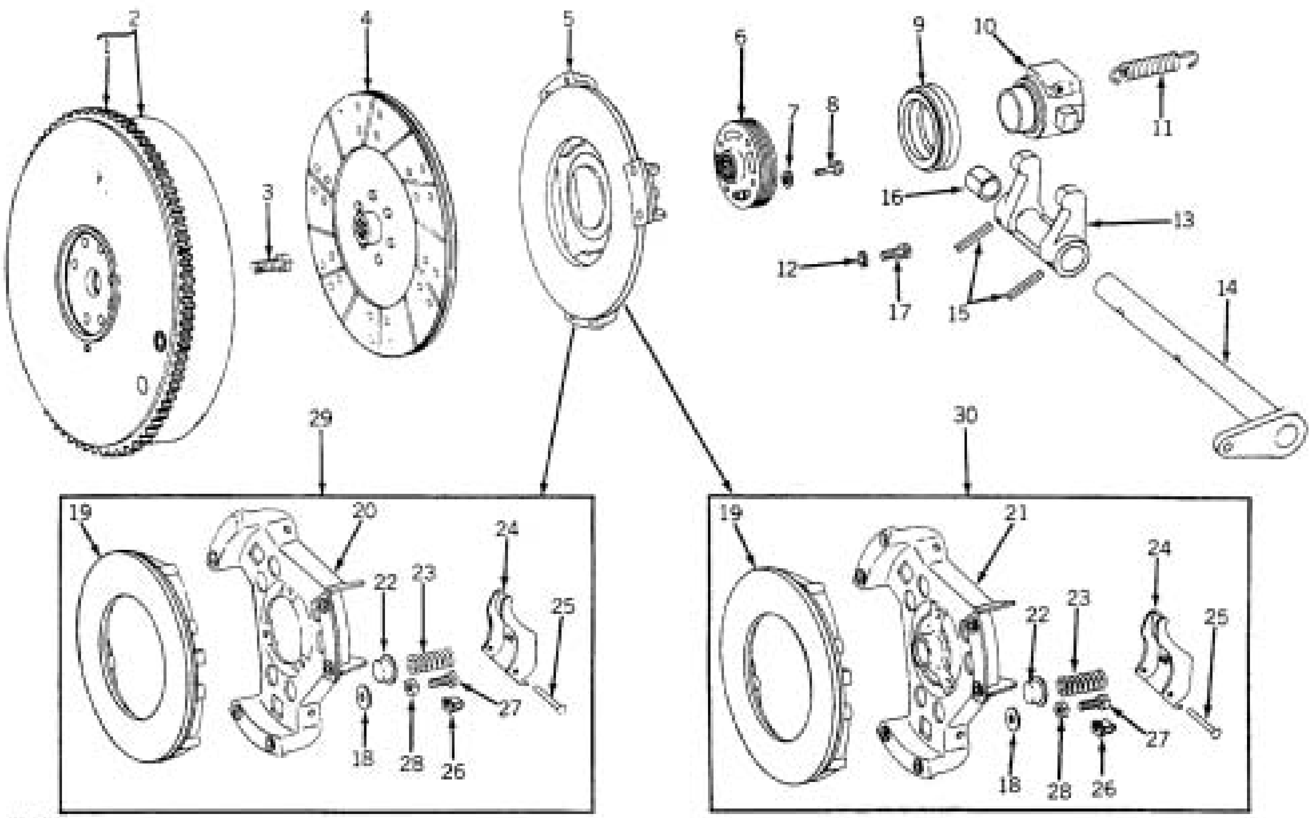
1—Ring Gear
2—Flywheel
3—Special Cap Screw (4 used)
4—Clutch Disk
5—Pressure Plate Assembly
6—Clutch Release Bearing
7—Carrier
8—Spring
9—Fork
10—Clutch Fork Shaft
11—Spring Pin (2 used)
12—Clutch Fork Shaft Bushing
13—Special Cap Screw (6 used)
14—Lock Washer (6 used)
15—Pressure Plate
16—Bracket
17—Spring (6 used)
18—Clutch Lever (3 used)
19—Link (3 used)
20—Spring Ring
21—Return Clip (3 used)
22—Adjusting Screw (3 used)
23—Pivot Pin (3 used)
24—Jam Nut (3 used)
25—Special Washer (3 used)

Fig. 4-Single Stage Clutch and Flywheel (No PTO) (Without Reverser)



1—Ring Gear
2—Flywheel
3—Ball Bearing
4—Clutch Disk
5—Throw-Out Bearing (-315693)
6—Cap Screw (10 used (-315693)
7—Lock Washer (8 used)
8—Oil Seal
9—Packing
10—Bearing Carrier Support
11—Fork (-315693)
12—Pin (2 used) (-315693)
13—Carrier (-315693)
14—Special Cap Screw (6 used)
15—Lock Washers (6 used)
16—Bushing
17—Spring
18—Spring Pin
19—Clutch Fork Shaft (-315693)
20—Pivot Pin (3 used)
21—Clutch Lever (3 used)
22—Return Clip (3 used)
23—Jam Nut (3 used)
24—Special Washer (3 used)
25—Special Screw (3 used)
26—Spring (3 used)
27—Clutch Bracket
28—Pressure Plate
29—Pressure Plate Assembly
30—Special Cap Screw (4 used)
31—Carrier with Bearing (315694-)
32—Clutch Fork (315694-)
33—Clutch Fork Shaft (315694-)
34—Cap Screw (4 used) (315694-)

Fig. 5-Single Stage Clutch and Flywheel (Continuous PTO or No PTO) (with Reverser)



1—Ring Gear
2—Flywheel
3—Special Cap Screw (4 used)
4—Clutch Disk
5—Pressure Plate Assembly
6—PTO Drive Damper (diesel)
7—Washer (3 used) (diesel)
8—Cap Screw (3 used) (diesel)
9—Clutch Release Bearing
10—Carrier
11—Spring
12—Lock Washer (6 used)
13—Fork
14—Clutch Fork Shaft
15—Spring Pin (3 used)
16—Bushing
17—Special Cap Screw (6 used)
18—Special Washer (3 used)
19—Pressure Plate
20—Bracket (diesel)
21—Bracket (gasoline)
22—Spring Cup (6 used)
23—Spring (6 used)
24—Clutch Lever (3 used)
25—Pivot Pin (3 used)
26—Return Clip (3 used)
27—Special Screw (3 used)
28—Jam Nut (3 used)
29—Pressure Plate (diesel)
30—Pressure Plate (gasoline)

Fig. 6-Single Stage Clutch and Flywheel (with independent PTO) (without reverser)

Check pressure plate for cracks, warped condition, or excessive wear. Check pressure springs in the assembly for damaged, weak, or rusty coils. Each part should be carefully inspected for wear and replaced if there is any question of its serviceability.

Pressure plate springs should check as follows:

Spring (17, Fig. 4)—Free length 3.075 inches [77.978 mm], Test length 1.685 inches [42.672 mm] at 124 pounds [56.245 kg].

Spring (26, Fig. 5)—Free length 2.445 inches [61.976 mm], Test length 1.687 inches [42.926 mm] at 234 pounds [106.140 kg].

Spring (23, Fig. 6)—Free length 2.396 inches [60.706 mm], Test length 1.570 inches [39.878 mm] at 170 pounds [77.110 kg].

Release levers, bracket, and pivot pins should be replaced if any wear is found on these parts. Note carefully the condition of return clips and replace as necessary.

Examine clutch facings. If there is any evidence of excessive wear, greasy condition or glazing, replace the disk.

If the splined hub is loose in the clutch disk, replaçe the complete disk.

Whenever in doubt as to the serviceable condition of any clutch part, replace it. Normally clutch facings should be replaced at the time of every major engine overhaul.

Clean flywheel and examine clutch friction surface for heat checks or other roughness. Remove any rough spots. If heat checks are excessive, a new flywheel must be installed.

Check pilot bearing for excessive wear or tight spots by rotating inner bearing race with finger.

If old bearing is defective, drive out and replace. Drive in new bearing (shielded side out) to bottom of counterbore with a driver which will contact only the outer bearing race.

Assemble release levers and bracket with new pivot pins.

Peen over ends of pins to secure assembly. Position spring in holes in clutch bracket.

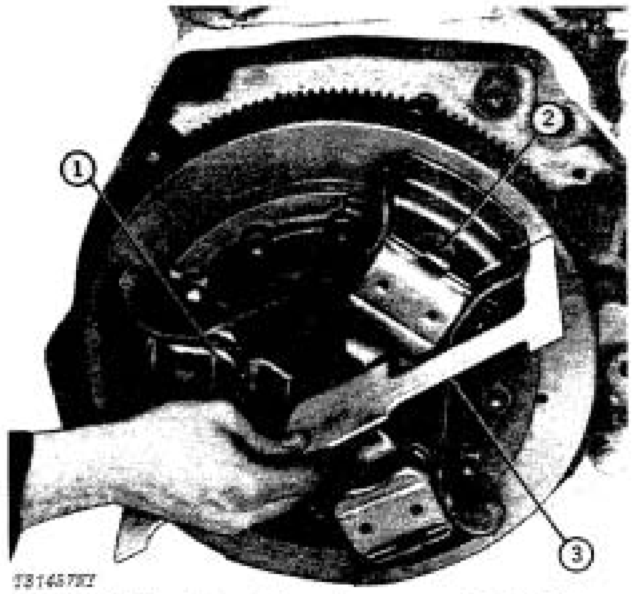
Place in press and depress the inner ends of the release levers as far as possible without forcing against bracket.

Install adjusting screws and jam nuts.

Using either a clutch disk centering shaft (JDE-52) or a tractor propeller shaft, position clutch pressure plate assembly over end of shaft and into place on rear of flywheel. **Long side of driven disk hub must face in toward flywheel on units without reverser. On units with reverser, long hub must face out.**

Install attaching cap screws and tighten securely.

Using a new clutch driven disk, bolt the clutch pressure plate and disk to a flywheel or fixture and adjust the setting of the clutch release levers using a JD-227 gauge.



1—Clutch Release Lever (3 used)
2—Adjustment Point
3—JD-227 Gauge

Fig. 7-Adjusting Clutch Release Levers

NOTE: On tractor with reverser, adjust the setting of the clutch release levers using a JD-7 gauge.

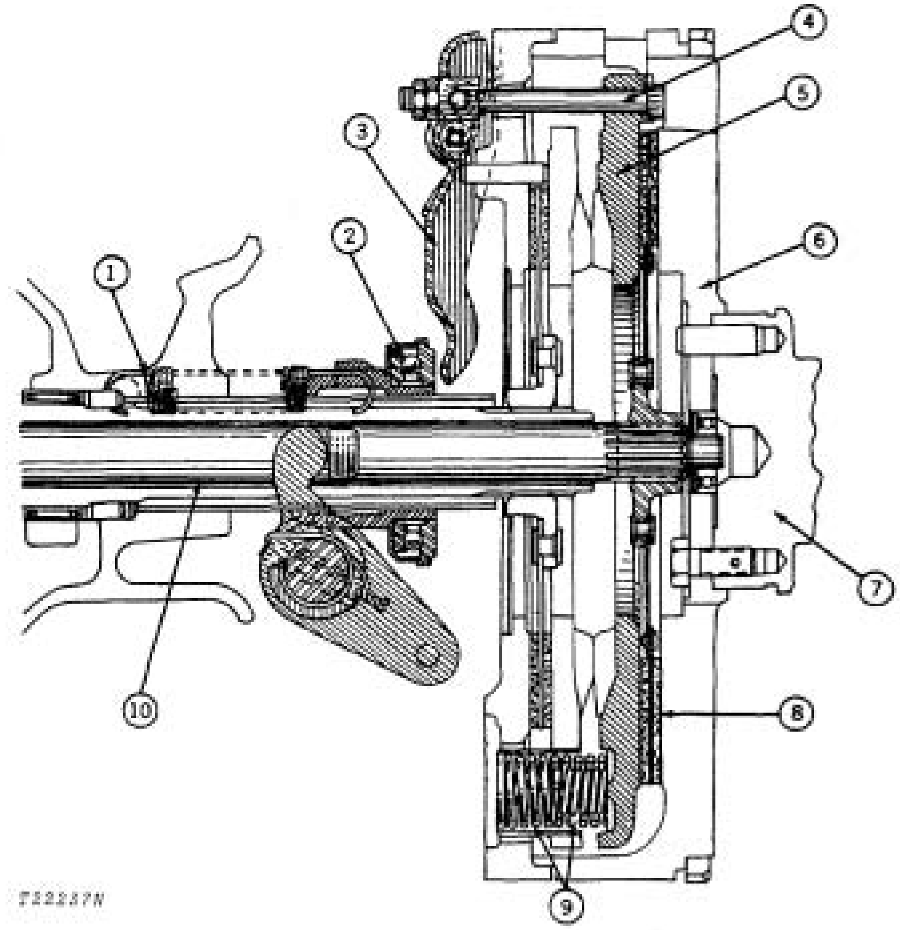
Place the gauge over the pressure plate with the gauge legs resting on the flywheel (not on any portion of the pressure plate rim) and with the step area of gauge over a release lever (Fig. 7). Move the adjusting screw in or out to place release levers at the proper level. Repeat the above procedure on the remaining release levers.

After the release levers are adjusted and lock nuts tightened, exercise the clutch levers several times. Recheck adjustment and change if necessary. If the levers dropped excessively, this process should be repeated until the setting is permanent.

IMPORTANT: To insure proper clutch functioning, the variation in the adjusted height of the release levers should not exceed .010-inch [0.254 mm].

Coat internal splines of clutch disk with John Deere Never-Seez or a rust inhibitor with the same specifications.

DUAL STAGE CLUTCH



1—Return Spring
2—Throw-Out Bearing
3—Operating Lever
4—Operating Bolt
5—Engine Clutch Plate
6—Flywheel
7—Crankshaft
8—Engine Clutch Disk
9—Springs
10—Engine Clutch Shaft

Fig. 8-Dual Stage Clutch

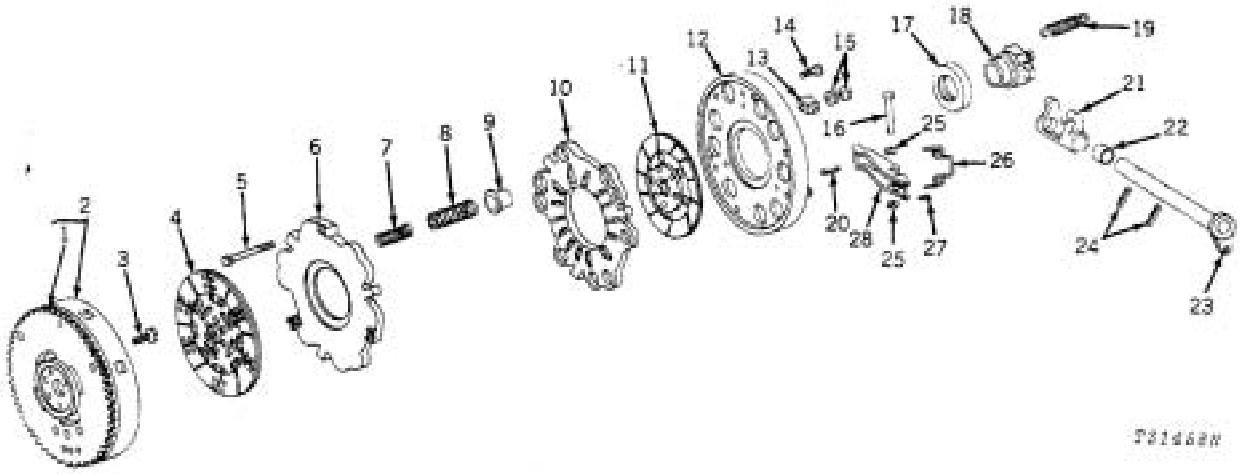
Repair

Refer to Fig. 9 for identification of parts and proceed as follows:

Remove the screws and lock plates which secure the clutch cover to the flywheel, and carefully withdraw the clutch pack. The engine clutch disk will remain in the flywheel, and can be lifted out for inspection, leaving the friction driving surface of the flywheel readily accessible. Avoid dropping clutch disk.

To remove the flywheel, remove the attaching cap screws and separate the flywheel from the crankshaft flange.

Place flywheel on a bench and install clutch assembly, securing with three evenly spaced cap screws. Install three long-thread cap screws with nuts and washers. Tighten nuts lightly against clutch cover and remove the three short attaching cap screws.



1—Ring Gear
2—Flywheel
3—Special Cap Screw (4 used)
4—Clutch Disk
5—Special Bolt (3 used)
6—Clutch Plate
7—Clutch Spring (9 used)
8—Outer Spring (9 used)
9—Spring Retainer (9 used)
10—PTO Clutch Plate
11—Disk
12—Clutch Cover
13—Lever Bar (3 used)
14—Cap Screw (6 used)
15—Jam Nut (6 used)
16—Headed Pin (3 used)
17—Clutch Release Bearing
18—Carrier
19—Spring
20—Special Dowel Pin (3 used)
21—Fork
22—Fork Shaft Bushing
23—Fork Shaft
24—Spring Pin (2 used)
25—Washer (6 used)
26—Spring (3 used)
27—Cotter Pin (3 used)
28—Clutch Lever (3 used)

Fig. 9-Engine and PTO Clutch and Flywheel (with continuous driven PTO) (without reverser)

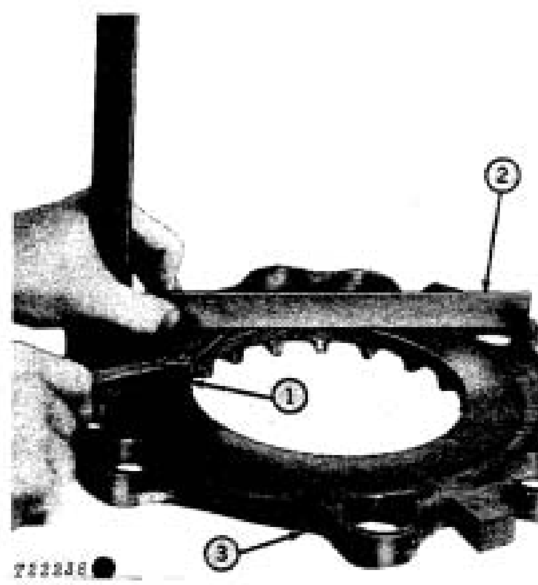
Remove clutch operating bolt jam nuts and lever bars. Loosen jack screw nuts evenly until spring pressure is released. Remove jack screws and lift off cover assembly. Lift out clutch components.

Clutch disk facings must be smooth, even and free from grease. The disk must not be warped. Check hub for cracks or loose rivets and hub splines for excessive wear.

If facing rivets are loose or if the facings are worn down to the rivets, the disk should be replaced.

Check friction driving surfaces (see Fig. 10) with a straightedge and a feeler gauge. If the surface is not true within 0.006-inch [0.1524 mm], or if groove or scores are present, the plate must be replaced.

If the PTO clutch plate has to be replaced, carefully drive the spring retainer cups out with a soft hammer. Support clutch plate area under each spring retaining cup and install cups.



1—Feeler Gauge
2—Straightedge
3—PTO Clutch Plate

Fig. 10-Checking Friction Surface (Clutch Plate Shown)

Defective springs will cause slippage, overheating and premature failure of the clutch disks.

The springs must be free of rust, pitting or distortion.

Springs should also be replaced if coils which have been closest to the clutch plate are noticeably closer together than the other coils.

Springs should check as follows:

Clutch spring (7, Fig. 9) for free length of 3.53 inches [89.7 mm], Test length of 1.75 inches [44.5 mm] at 56 pounds [25.4 kg]).

Outer spring (8, Fig. 9) free length 3.06 inches [77.7 mm], Test length 1.85 inches [47.0 mm] at 123 pounds [55.7 kg].

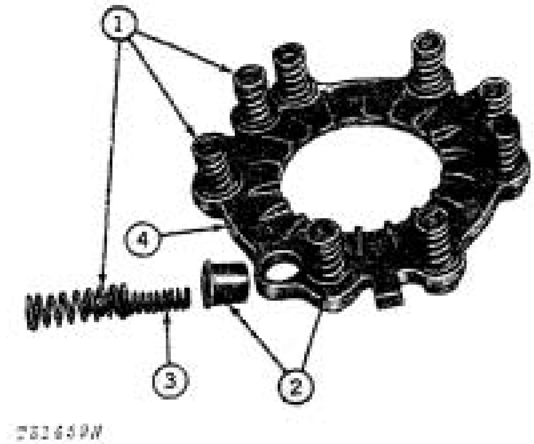
Check flywheel friction driving surface for flatness before removal. Use a straightedge and feeler gauge. If the surface is out of true more than 0.006-inch [0.1524 mm] or is scored or grooved, the surface must be reconditioned or the flywheel replaced.

Check pilot bearing for excessive wear or tight spots by rotating inner bearing race with finger.

If old bearing is defective, drive out and replace. Drive in new bearing (shielded side out) to bottom of counterbore with a driver which will contact only the outer bearing race.

Position engine clutch disk in flywheel, long hub down. Insert the three operating bolts in clutch plate and install clutch plate in flywheel.

IMPORTANT: Be sure that operating bolt heads are properly seated in the recesses in the clutch plate. Failure to do so will result in damage to the clutch parts.



1—Outer Spring (9 used)
2—Spring Retainer (9 used)
3—Inner Spring (9 used)
4—PTO Clutch Plate

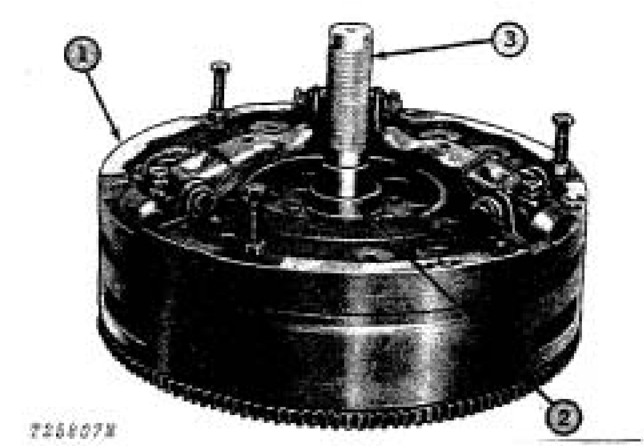
Fig. 11-Clutch Spring Assembly

Position clutch springs as shown in Fig. 11.

On early units six inner springs (3) were used. For increased clutch capacity, nine inner springs (3) can be used.

Install PTO clutch plate. Be sure that all springs are properly seated in their respective retainers.

Position PTO clutch disk with long hub upward. Position clutch cover assembly on flywheel. Be sure that clutch operating bolts are properly aligned with holes in cover.



1—Clutch Cover
2—PTO Clutch Disk (long hub up)
3—Aligning Tool (JDE-52-1)

Fig. 12-Installing Clutch Cover

Insert JDE-52-1 centering tool into clutch assembly to align PTO clutch disk and engine disk with flywheel pilot bearing (Fig. 12).

With JDE-52-1 centering tool in clutch assembly, install jack screws in equally spaced holes (Fig. 12), and tighten jack screw nuts evenly to compress clutch springs.

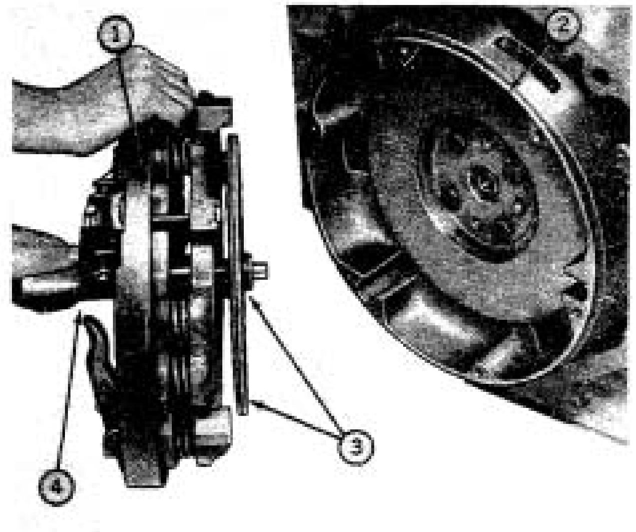
Insert PTO clutch release pins in clutch cover. Install operating levers with springs. Install jam nuts on operating bolts, screw them down, and remove jack screws.

Tighten clutch operating bolt nuts to hold bearing surface of clutch operating levers 1.250 inches [31.750 mm] from finished circular face of clutch cover, then tighten lock nuts.

Carefully withdraw the clutch pack assembly and engine clutch disk from the flywheel.

Install flywheel on crankshaft.

NOTE: Before installing cap screws, the "D" grade cap screws should be replaced with the "F" grade cap screws and hardened washers. Tighten the "F" grade cap screws to 120 lb-ft (163 Nm) (17 kg-m). Tighten "D" grade cap screws to 85 lb-ft (115 Nm) (12 kg-m).



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1—Clutch Assembly
2—Flywheel
3—Engine Clutch Disk
4—Aligning Tool (JDE-52-1)

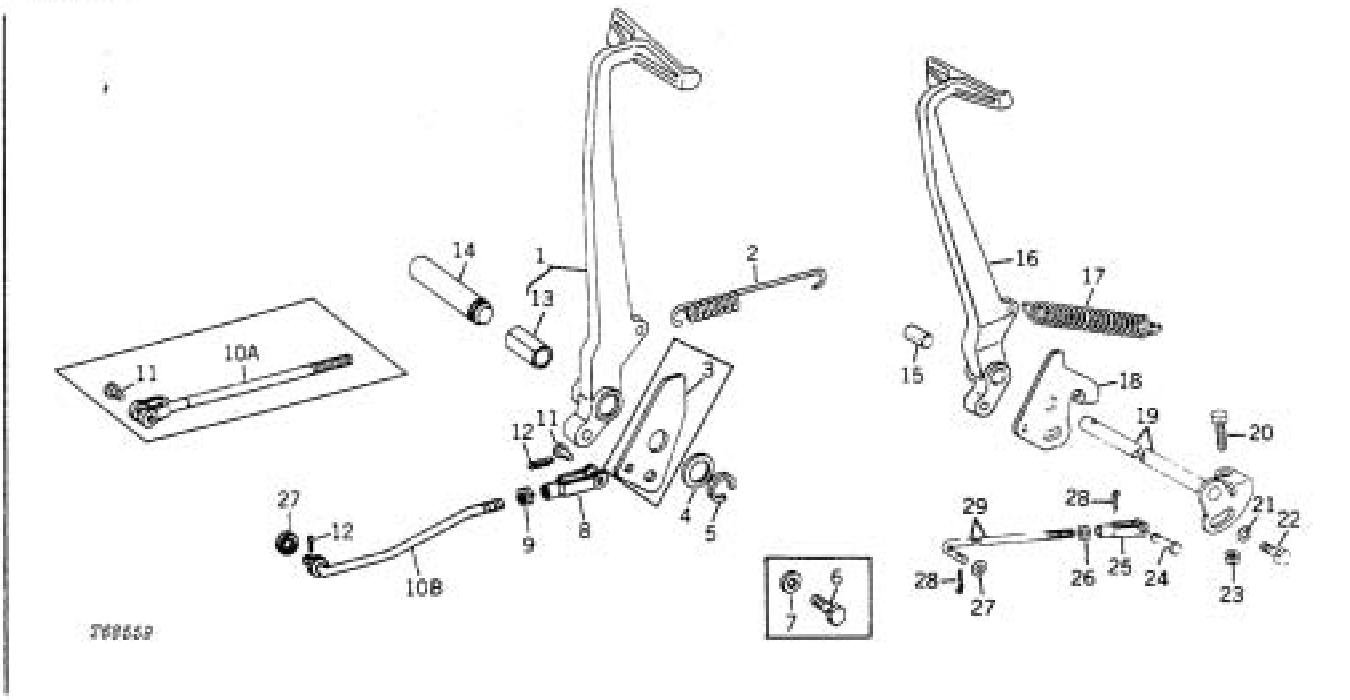
Fig. 13-Installing Clutch Assembly

Position clutch pack assembly and engine clutch disk (long hub to front) on end of centering tool to maintain clutch disk alignment (Fig. 13). Insert end of centering tool in flywheel pilot bearing and slide clutch pack assembly in place. Tighten attaching cap screws.

Coat internal splines of clutch disks with John Deere Never-Seez or equivalent.

CLUTCH AND CONTROLS

Repair



Without Reverser **With Reverser**

1—Clutch Pedal (-297160)
Clutch Pedal (297161-)
2—Spring
3—Arm (-297160)
4—Washer
5—Snap Ring
6—Cap Screw (-297160)
7—Washer (-297160)
8 —Yoke
9 —Jam Nut
10A—Clutch Rod (-303897)
10B—Clutch Rod (303898-)
11 —Headed Pin (2 used) (-303897)
Headed Pin (303898-)
12—Cotter Pin (2 used)
13—Bushing
14—Pedal Pivot Shaft
15—Bushing
16—Clutch Pedal
17—Pedal Return Spring
18—Pedal Arm
19—Pedal Shaft
20—Special Cap Screw
21—Washer
22—Cap Screw
23—Jam Nut
24—Headed Pin
25—Yoke
26—Jam Nut
27—Washer (2 used)
28—Cotter Pin (3 used)
29—Fork Shaft Rod

Fig. 14-Clutch Controls (with and without reverser)

Clutch Throw-Out Bearing and Bearing Carrier

Check throw-out bearing for evidence of overheating. If bearing appears to have been overheated or is rough, replace it.

Throw-out bearing should not be soaked in solvent as it is pre-packed with grease. Wipe clean with cloth dampened in solvent. NEVER attempt to oil the bearing.

If throw-out bearing requires replacing, press new bearing onto carrier with highly polished surface out. Index notch in bearing race with grease passage in bearing carrier.

Prevent damage to bearing balls by inserting a block of wood between bearing and arbor or similar means to rotate bearing while installing. Do not use excessive pressure.

Check Pedal and Pedal Pivot Shaft

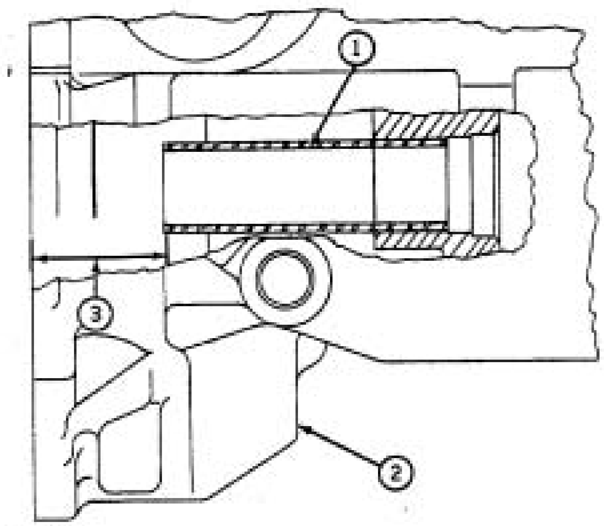
Inspect all parts of clutch pedal control linkage for wear or damage.

Clutch Throw-Out Yoke

Inspect clutch throw-out yoke for evidence of binding or distortion.

Check for cracks in yoke, wear in attaching holes, or wear along surface of yoke which comes in contact with clutch throw-out bearing carrier.

Clutch Throw-out Bearing Carrier Sleeve (without reverser)



1—Sleeve
2—Clutch Housing
3—Specified Dimension (2-13/16 inch) [71.374 mm]

Fig. 15-Installing Carrier Sleeve

Inspect clutch throw-out bearing carrier sleeve for wear or damage. If sleeve is damaged, remove from clutch housing and press in new sleeve to 2-13/16 inch [71.374 mm] from the end of sleeve to the engine mounting surface of the clutch housing (Fig. 15).

Clutch Housing

Unless the clutch housing, clutch shafts, or the bearings and seals which support these parts in the clutch housing are worn or damaged, it will not be necessary to remove clutch housing from the tractor.

If necessary, remove clutch housing from transmission as instructed on page 40-5-2.

Inspect clutch shaft bushing in clutch housing for wear or damage. If necessary, press in new bushing in flush with outer edge of bore.

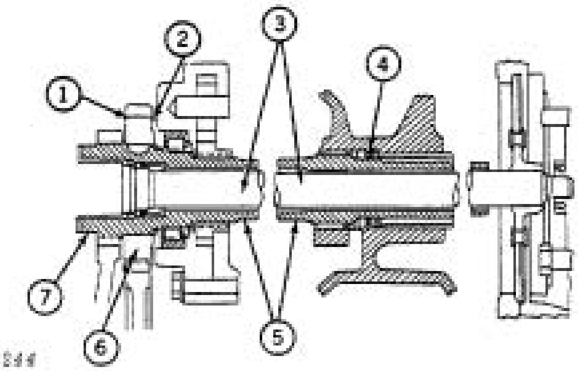
Inspect clutch shaft pivot shaft for damage. Press new pivot shaft in clutch housing to protrude 2-1/2 inch [63.500 mm] from clutch housing.

Inspect needle bearing (powershaft) or pivot (clutch shaft) and oil seal in center of clutch housing (Fig. 16) for damage or oil leakage in clutch compartment. To replace oil seal, bearing (or pilot) must be removed. Drive new oil seal in clutch housing to specifications (1-5/16 inch) [33.274 mm] with sealing lips facing driver. Press in new needle bearing (power shaft) or pilot (clutch shaft) to bottom of chamfer at end of bore.

Clutch Shaft and Powershaft Clutch Shaft

Remove clutch shaft and powershaft clutch shaft (if equipped) out rear of clutch housing.

Inspect shaft for wear or damage.



1—Flat Side
2—Stepped Side
3—Clutch Shaft
4—Oil Seal
5—Power Shaft Clutch Shaft
6—Drive Gear
7—Integral Gear

Fig. 16-Clutch Shaft Parts

If tractor is equipped with a continuous-running PTO, check for evidence of oil seeping between clutch shaft and powershaft clutch shaft at pilot end.

Pull shafts apart and check oil seal in rear of powershaft clutch shaft. Remove oil seal and inspect pilot at bottom of bore for damage. Press in new oil seal, with lips of seal facing driver, to rear surface of pilot in bore.

If PTO drive gear is removed from powershaft clutch shaft, be sure to install gear with flat side to rear (toward integral gear on shaft). See Figure 16.

Installation

Join clutch housing and engine as outlined in Section 20, Group 5.

Refer to page 40-5-2 and install all parts removed.

To adjust clutch assembly refer to Section 70, Group 20.

Group 10
TRANSMISSION

GENERAL INFORMATION

The transmission is a collar shift type using helical gears. Two shift levers manually select four gears in each of three ranges (two forward and one reverse). This provides eight forward and four reverse speeds.

NOTE: Units starting with S.N. (277182) will not have the high range reverse lockout.

The transmission gear train is contained in a single compartment of the transmission case. The transmission gears are carried on three shafts—the transmission drive shaft, the differential drive shaft and the countershaft.

A neutral start switch is provided. The range shift lever must be in neutral or in park (P) position before the engine can be started.

Refer to Section 30, Group 15 for adjustment of neutral start switch.

REMOVAL

For transmission removal follow steps given under "Clutch and Controls", page 40-5-2.

If clutch housing is to be removed to service transmission, disconnect clutch housing from transmission as instructed.

Mount a JDG-2K front splitting stand on flywheel housing and a JDG-2A rear splitting stand on final drives.

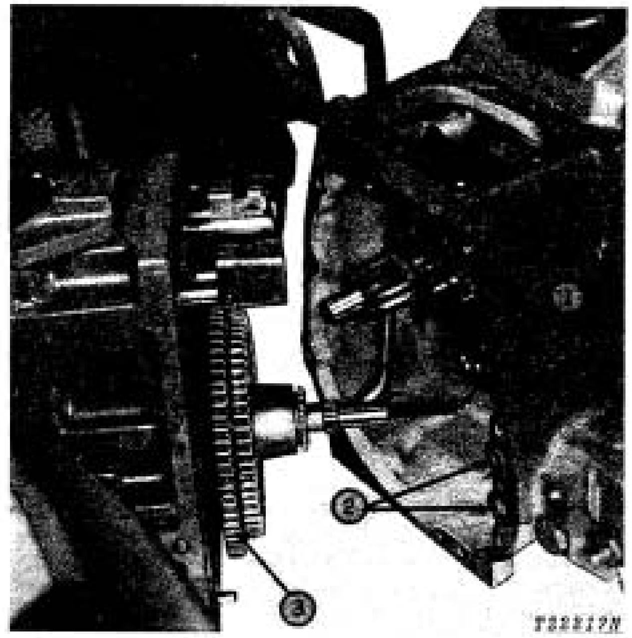
Roll clutch housing with engine and front end attached away from transmission.

Remove rockshaft housing if so equipped. Refer to Section 50, Group 55.

Remove neutral start switch pin from low range shifter fork.

Remove set screws securing shifters to shifter shafts.

A tool for removal and installation of interlock balls may be produced locally. See "Special Tools," Section 40, Group 35.



1—PTO Spring and Ball
2—O-Rings
3—PTO Gears

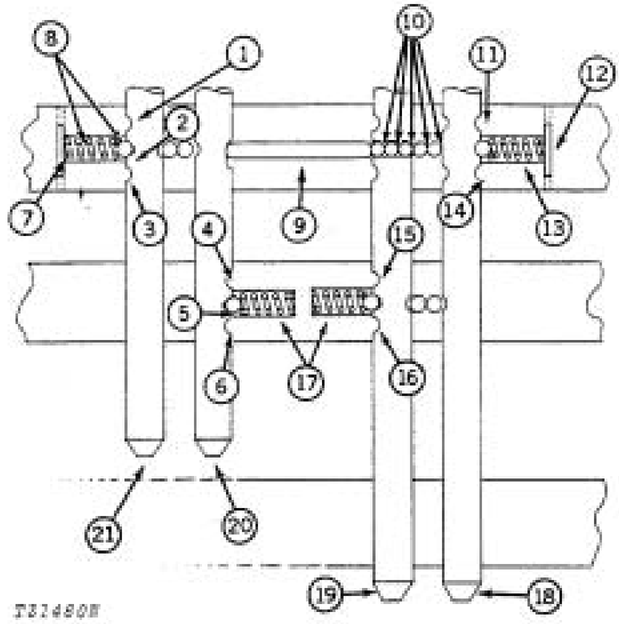
Fig. 1-Splitting Tractor Between Clutch Housing and Transmission

Shifter shaft may be removed from case without removing the balls and springs. This is accomplished by placing the open end of tool to tapered end of shifter shaft to be removed. Push shaft from its bore with the tool. Leave tool in bore until ready to reposition shifter shaft and push tool out of bore with shifter shaft.

Do not turn shifter shafts during removal as spring-loaded detent balls can become lodged in the shifter fork set screw holes in the shafts.

Shift low and reverse range shifter shaft (3, Fig. 3) and high range shifter shaft (4) into neutral position and pull low and reverse range shifter shaft from transmission case.

Be careful not to lose the three (5/16-inch [7.874 mm]) balls in shifter shaft front detent hole (Fig. 3).



1—Low
2—Neutral
3—Reverse
4—Park
5—Neutral
6—High
7—Spring Pin
8—Detent Ball and Spring
9—Interlock Pin
10—Interlock Balls
11—1st and 5th Speed Position
12—Spring Pin
13—Spring
14—2nd and 6th Speed Position
15—4th and 8th Speed Position
16—3rd and 7th Speed Position
17—Detent Ball and Spring
18—Speed Shifter Shaft 1st and 5th - 2nd and 6th
19—Speed Shifter Shaft 3rd and 7th - 4th and 8th
20—Park and High Range Shifter Shaft
21—Low and Reverse Range Shifter Shaft

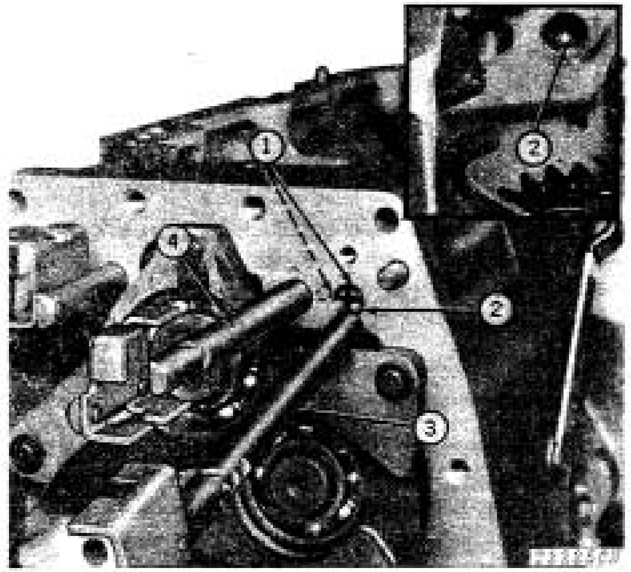
Fig. 2-Shifter Mechanism

Shift inside speed shifter shaft into gear (to release interlock pin) and pull the high range shifter shaft from transmission case, being careful not to lose one (5/16-inch) (7.874 mm) ball and spring in shifter shaft rear bottom detent hole (see inset in Fig. 3).

Remove shifters from low and reverse sliding gear and high and park range pinion inside transmission case.

To remove high and park range pinion, first remove transmission front bearing support.

Pull inside speed shifter shaft out of transmission case until three (1/4-inch) (6.350 mm) balls can be removed from shaft as shown in Fig. 4. Then pull shaft out of transmission case, being careful not to lose three (5/16-inch) (7.874 mm) balls in shifter shaft rear detent hole (see inset in Fig. 4).

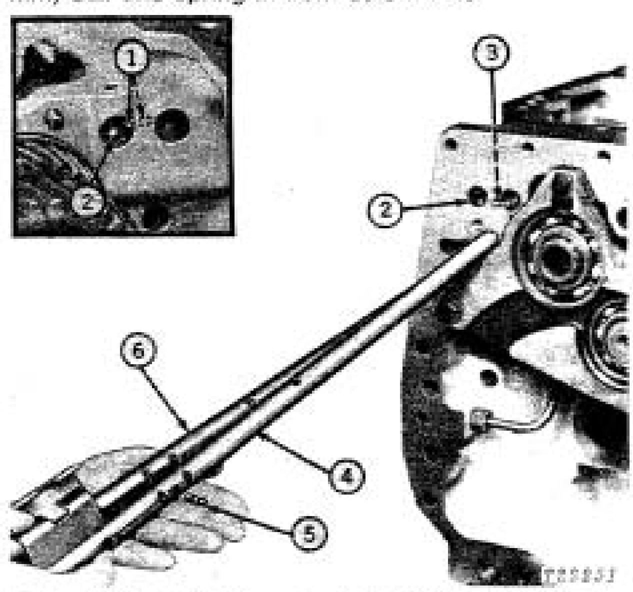


1—Two 5/16-inch (7.874 mm) Balls Between Shafts
2—One 5/16-inch (7.874 mm) Ball and Spring
3—Low and Reverse Range Shifter Shaft
4—High Range Shifter Shaft

Fig. 3-Removing Range Change Shifter Shaft

Remove two (1/4-inch (6.350 mm) balls between speed shifter shafts at front detent hole.

Pull outside speed shifter shaft out of transmission case, being careful not to lose one (5/16-inch) (7.874 mm) ball and spring in front detent hole.



1—Two 5/16-inch (7.874 mm) Balls Between Shafts
2—One 5/16-inch (7.874 mm) Ball and Spring
3—Two 1/4-inch (6.350 mm) Balls Between Shafts
4—Inside Shifter Shaft
5—Three 1/4-inch (6.350 mm) Balls
6—Outside Shifter Shaft

Fig. 4-Removing Speed Change Shifter Shafts

Remove shifter forks from the appropriate shifter collars.

Refer to Fig. 5 for identification and relative location of parts. Inspect the following items:

Shifters

Check shifters for excessive wear or bent condition and replace if necessary.

Shifter Shaft Parts

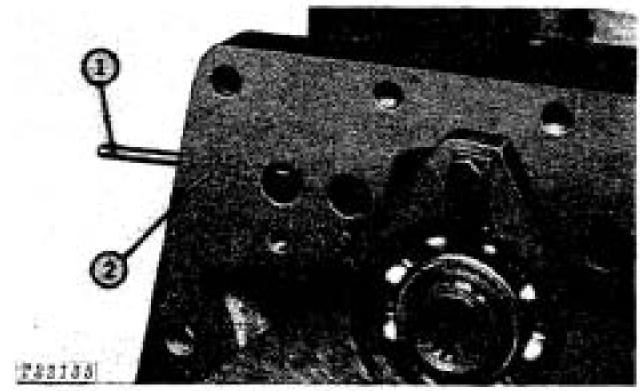
Make sure shafts are straight. examine the area around the interlock notches and holes for wear and replace if necessary. Inspect shift guides on end of shafts for damage.

Inspect shifter shaft bores in transmission case for burrs or other damage.

Interlock Pin, Balls, and Springs

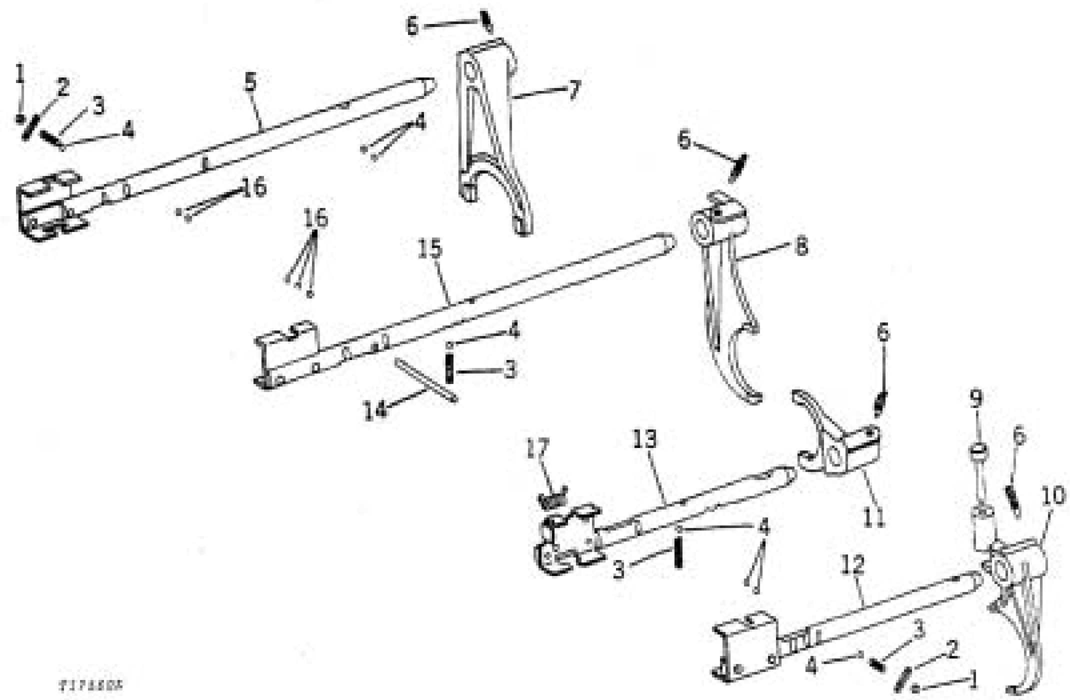
Check springs to be sure they have not taken a permanent set. Replace if necessary.

Inspect all balls for any flat surfaces.



1—Interlock Pin 2—Spring Pin

Fig. 6-Removing Interlock Pin



1—Detent Plug (3 used)
2—Spring Pin (2 used)
3—Spring (4 used)
4—Ball, 5/16" (8 used)
5—1st and 5th, 2nd and 6th Speed Shifter Shaft
6—Special Set Screw (4 used)
7—1st and 5th, 2nd and 6th Speed Shifter
8—3rd and 7th, 4th and 8th Speed Shifter
9—Pin
10—Low and Reverse Range Shifter
11—High Range Shifter
12—Low and Reverse Range Shifter Shaft
13—High Range Shifter Shaft
14—Pin (without parking brake)
15—3rd and 7th, 4th and 8th Speed Shifter Shaft
16—Ball, 1/4" (5 used) (without parking brake)
17—Spring (without parking brake)

Fig. 5-Gear Shifters and Shifter Shafts

Inspect interlocking pin in transmission case for damage. If pin is to be replaced, drive spring pin through front wall of transmission case and push interlock pin out right side of transmission case (Fig. 6).

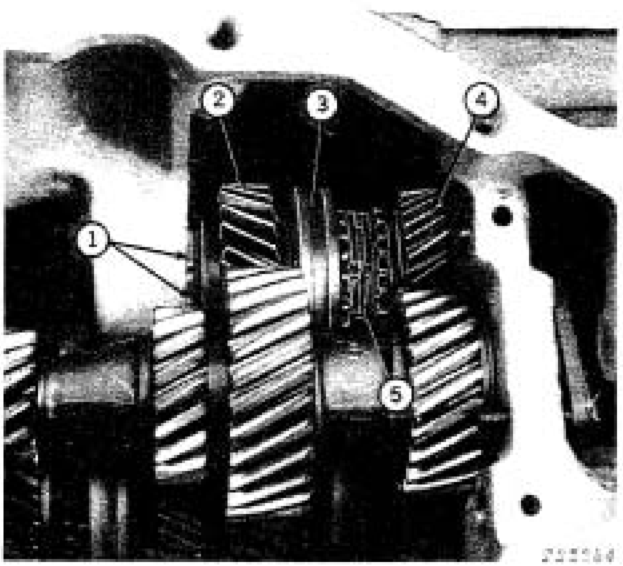
Insert new pin in from right side of transmission case and replace plug and spring pin.

Remove PTO drive gears from front of transmission.

Remove transmission lubricating oil cup with oil lines.

Countershaft

Remove cap screws securing bearing support to front of transmission.



1—Snap Ring
2—Low Range Pinion
3—Collar
4—Reverse Range Pinion
5—Locking Washer

Fig. 7-Removing Countershaft

Remove snap ring from groove at rear of countershaft.

Rotate the locking washer (Fig. 7) until the splines on the washer index with the countershaft splines.

Pry the bearing support off the dowels on the front of the transmission case. As the bearing support, countershaft, and transmission drive gear are pulled forward, the gears and shifter collar will slide off the rear of the countershaft. Keep these parts in order to aid in assembly.

Transmission Drive Shaft

Remove transmission drive shaft front bearing quill, shims, and front lubricating oil line.

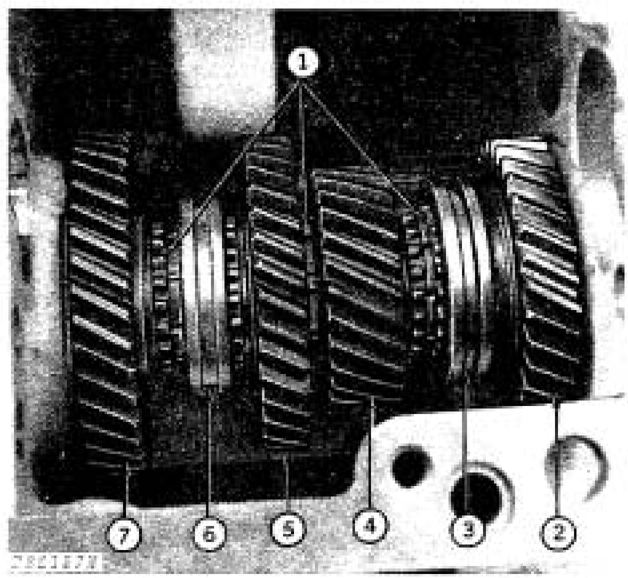
Tap transmission drive shaft forward to free front bearing cup from case and rear bearing cone from cup.

Move transmission drive shaft forward and work rear end of shaft up through top of transmission case.

Differential Drive Shaft

To service differential drive shaft, block up transmission case and remove final housing from tractor.

Remove differential assembly as instructed Section 40, Group 25.



1—Locking Thrust Washers
2—3rd and 7th Speed Gear
3—Collar
4—4th and 8th Speed Gear
5—2nd and 6th Speed Gear
6—Collar
7—1st and 5th Speed Gear

Fig. 8-Removing Differential Drive Shaft

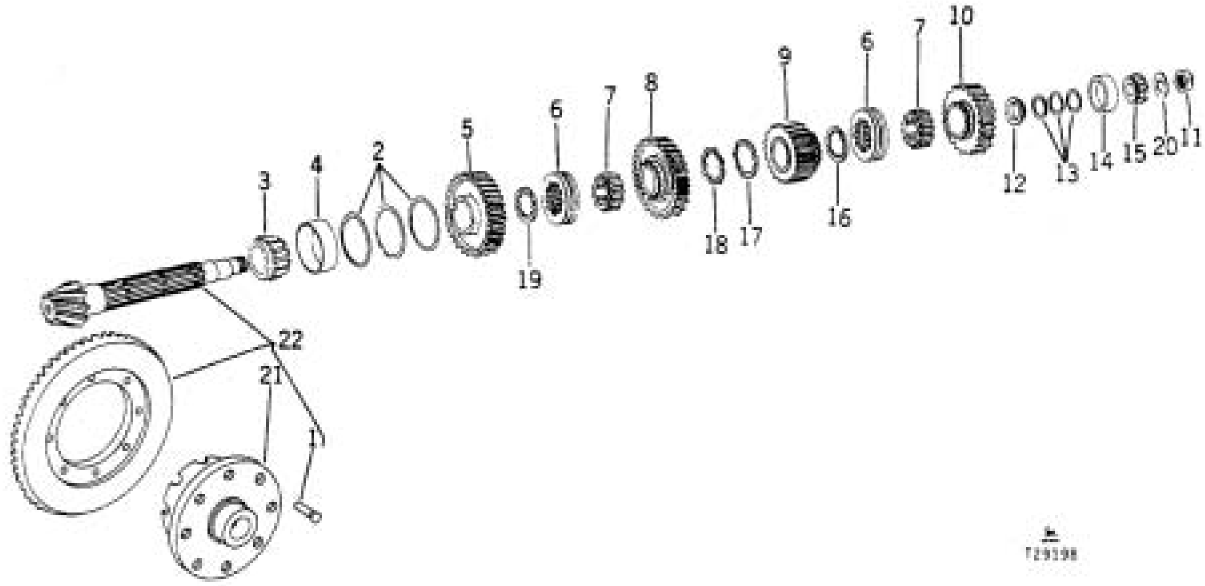
Remove hex. nut, washer, bearing, shim pack, and spacer from the front of the differential drive shaft.

Locate the three locking thrust washers on the drive shaft (Fig. 8). Rotate the thrust washers in their grooves until the splines on the shaft and washers index.

Pull drive shaft to the rear until it can be lifted from the differential compartment. Keep these parts in order to aid in assembly.

REPAIR

Differential Drive Shaft



1—Rivet (8 used)
2—Shim (as required)
3—Bearing Cone
4—Bearing Cup
5—First and Fifth Speed Gear (40 teeth)
6—Collar (2 used)
7—Shifter Collar Sleeve (2 used)
8—Second and Sixth Speed Gear (36 teeth)
9—Fourth and Eighth Speed Gear (27 teeth)
10—Third and Seventh Speed Gear (31 teeth)
11—Special Nut
12—Spacer
13—Shim (as required)
14—Bearing Cup
15—Bearing Cone
16—Thrust Washer
17—Retaining Washer
18—Thrust Washer
19—Thrust Washer
20—Special Washer
21—Differential Housing
22—Ring Gear and Pinion

Fig. 9-Differential Drive Shaft

If the differential drive shaft is no longer serviceable and must be replaced, also replace the ring gear as described Section 40, Group 25. These parts are furnished as matched sets and are not available individually for replacement.

If either a new transmission case, differential assembly, or differential drive gear with bearing cups and cones is to be installed, it will be necessary to (1) check and adjust differential drive shaft preload and cone point as explained further on in this group and (2) set proper backlash between drive shaft and differential assembly as explained in Section 40, Group 25.

Transmission Drive Shaft

1—Bearing Cup
2—Bearing Cone
3—Transmission Drive Shaft
4—Needle Bearing
5—Dowel Pin
6—Bearing Cone
7—Bearing Cup
8—Shim (as required)
9—Lock Plate (3 used)
10—Cap Screw
11—High Range Shifter Collar (without parking brake)
12—Cap Screw
13—Cap Screw
14—Quill (without parking brake)
15—High Range Shift Collar (with parking brake)
16—Quill (with parking brake)

Fig. 10-Transmission Drive Shaft

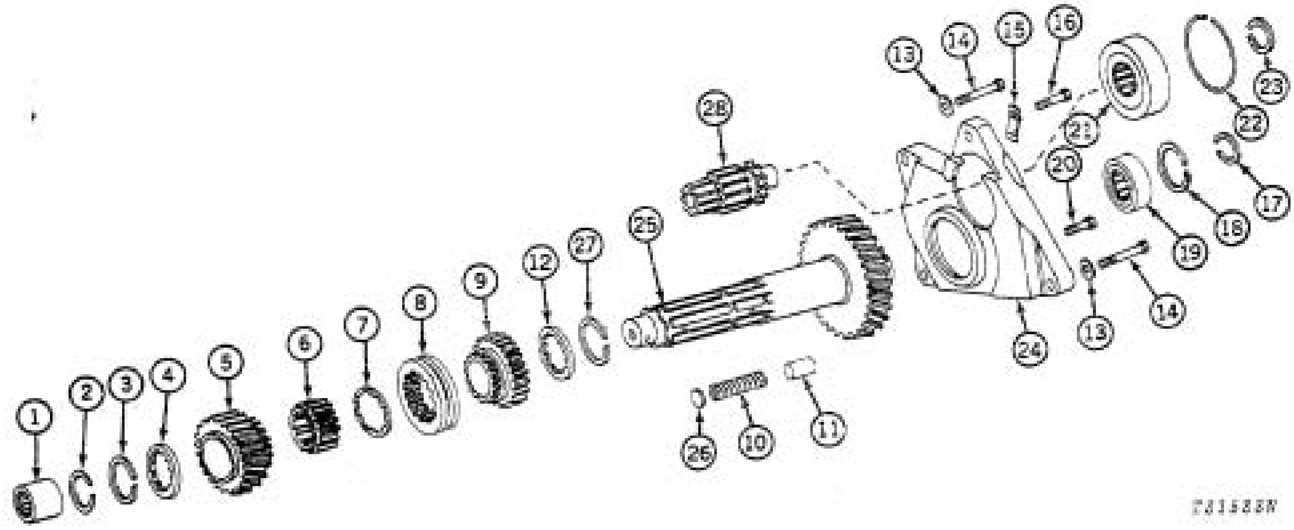
Inspect teeth on all integral driving gears for excessive tooth wear or broken teeth.

Examine bearings on shaft for damage or wear and replace if necessary.

Inspect front quill and high range shifter collar for wear or damaged condition.

Inspect needle bearings, retainer and shims for damage.

Countershaft



1—Needle Bearing
2—Snap Ring
3—Snap Ring
4—Thrust Washer
5—Low Range Pinion (22 teeth)
6—Sleeve
7—Thrust Washer
8—Collar
9—Reverse Range Pinion (without reverser) (21 teeth)
10—Spring (2 used
11—Friction Plug (2 used)
12—Thrust Washer (without reverser)
13—Special Washer (2 used)
14—Cap Screw (2 used)
15—Clamp
16—Cap Screw
17—Snap Ring
18—Snap Ring
19—Ball Bearing
20—Cap Screw
21—Ball Bearing
22—Snap Ring
23—Snap Ring
24—Countershaft Bearing Support
25—Countershaft
26—Spacer (2 used) (with reverser)
27—Snap Ring (without reverser)
28—Transmission Drive Gear (12 teeth)

Fig. 11-Countershaft and Bearing Support (without independent PTO)

If bearing support, countershaft, transmission drive gear, or bearings which support these parts need to be replaced, remove snap rings securing bearings to support and shafts and press shafts out of bearing support.

The transmission drive gear must be removed before the countershaft can be removed.

Press new shafts or bearings in support until all snap rings fit in their proper grooves.

Install shifter collar sleeve (6) **with protruding teeth toward front of transmission case.** Teeth must engage with thrust washer (7).

Ball bearing (21) must be assembled with the end opposite the snap ring groove entering first.

Inspect friction plugs (11) for wear and replace if necessary.

Check friction plug springs (10) against specifications.

Free length, 1.87 inches [47.5 mm] Test length, 1.51 inches [38.4 mm] at 70 pounds [31.8 kg].

Transmission Oiling System

Inspect transmission front and rear oil lines for damage. Make sure oil lines are not plugged and oil can flow out small holes along bottom of rear oil line.

Inspect oil cup O-ring in bottom of seat bore.

Remove oil sump cover at bottom of transmission case. Clean reservoir at bottom of case and replace cover.

Transmission Case

Clean transmission case thoroughly and inspect for cracks or other damage.

Inspect oil level rod and tube for damage and replace if necessary. If tube is damaged, remove old tube and press in new tube. Distance from the top of the tube to the top milled surface of the transmission case is 7-25/32 inches (197.612 mm).

ASSEMBLY

(1) Cone Point Adjustment

Cone point adjustment is obtained by controlling the shim pack between the differential drive shaft rear bearing cup and the transmission case.

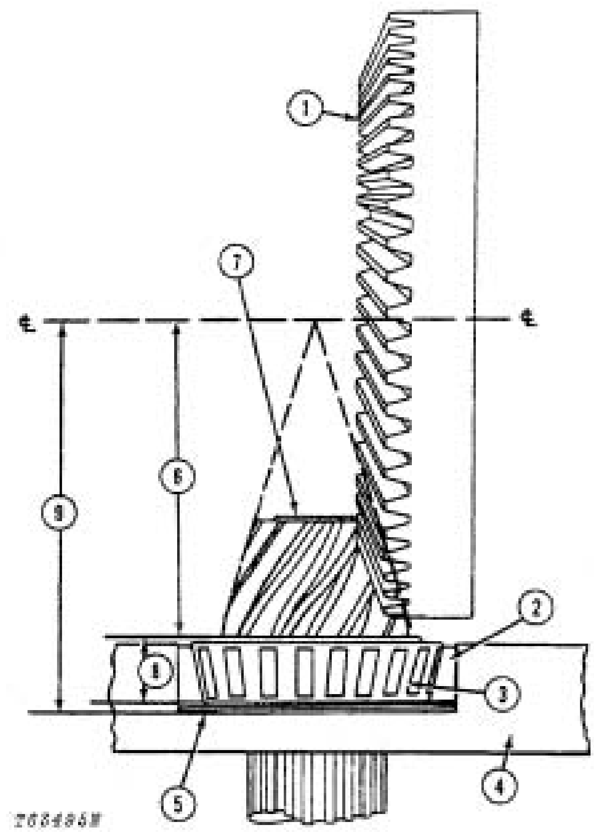
The following dimensions are required for correct cone point adjustment.

A. Nominal measurement of the differential drive shaft bearing cone and cup (1.446 inch) (36.576 mm).

B. Dimension etched on the face of the bevel pinion.

C. Dimension stamped on the top rear of the transmission case. If the dimension is not stamped on the transmission case, use the dimension given in the example to determine the shim pack.

To determine shim pack, subtract the measurement found in steps A and B from measurement observed in step C.



1—Ring Gear
2—Bearing Cup
3—Bearing Cone
4—Differential Compartment Wall
5—Shims
6—Dimension of Pinion Cone
7—Etched Dimension on Pinion
9—Bearing Overall Width
9—Dimension Stamped On Transmission Case

Fig. 12-Ring Gear and Pinion Cone Point Adjustment

Example:

6.352 in. (161.34 mm)	-	dimension (6, Fig. 12) etched on end of pinion shaft
+ 1.446 in. (36.73 mm)	-	bearing overall width (8)
= 7.798 in. (198.07 mm)	-	sum of steps A and B
7.813 in. (198.45 mm)	-	dimension (9) stamped on transmission case
− 7.798 in. (198.07 mm)	-	sum of steps A and B
= 0.015 in. (0.38 mm)	-	cone point shim pack

Insert differential drive shaft with rear bearing cone into differential compartment and slide shaft forward about one-half the distance of the shaft into transmission compartment.

Refer to Figure 9, page 40-10-5 for identification and sequence of parts installed on differential drive shaft.

Thrust washers (16, 18 and 19, Fig. 9) are to lock in grooves on pinion shaft. Splines on shifter collar sleeve (7) are to interlock with thrust washers.

(2) Preload Adjustment

Measure end play to obtain 0.006 inch (0.15 mm) preload.

Install the proper shim pack, bearing cone, washer, and hex. nut. Be sure bent tang on washer faces out toward threaded end of shaft. Tighten nut to 160 lb-ft (22.121 kg-m) and stake it.

NOTE: If differential drive shaft is removed to aid in checking or adjusting differential assembly preload as described in Section 40, Group 25, be careful that the differential drive shaft preload shim pack is not damaged or lost.

Transmission Drive Shaft

Install transmission drive shaft into case and slip it to the rear so that the bearing cone seats in rear bearing cup.

End Play Adjustment

Adjust transmission drive shaft to 0.004 to 0.006 inch (0.102 to 0.152 mm) end play. Tighten quill attaching cap screws.

Countershaft

Be sure high range collar and high and park range shifter is installed on front of transmission drive shaft before installing countershaft assembly.

Install countershaft assembly and secure bearing support assembly to transmission case.

Install transmission oil cup and rear oil line. Tighten oil cup-to-transmission case cap screw.

To be sure of final drive lubrication, ends of oil tubes must extend into or be flush with inner edge of final drive compartment so that oil is directed into each final drive compartment. Hand bend tubes if necessary.

Check for interference of oil lines with shafts. Also check for proper engagement of oil line adapters into ends of shafts.

Install PTO drive gear to front of transmission.

Refer to Figures 2 through 6 for proper relationship of parts when assembling shifter mechanism.

Install spring and insert special tool (end with indentation) to just past hole for the ball. Slide ball in indentation to hole and push tool into bore of case approximately 2-inches (51 mm). Rotate tool 1/4 turn.

Insert tapered end of shifter shaft in outer open end of tool. Push the tool on through the shifter shaft bores with the shifter shaft.

Refer to Section 50, Group 55 and install rockshaft housing on transmission.

Shift levers through all ranges and gears to check for proper operation of shifters.

INSTALLATION

Refer to Section 40, Group 5 and join transmission to clutch housing.

Group 15
REVERSER

GENERAL INFORMATION

The reverser is a hydraulic and mechanical device which changes the direction of tractor travel under full load without shifting transmission gears. A single compound planetary set of gears, a reverse brake, and one clutch are utilized to accomplish this type of directional shifting.

A single stage dry clutch is provided on the engine flywheel ahead of the reverser unit to disconnect the reverser during cold weather starting.

REMOVAL

NOTE: If the reverser unit is not functioning properly, follow the test procedures outlined in Section 70, Group 25 to locate the difficulty before attempting to remove and disassemble the reverse unit.

Remove reverser assembly from tractor as outlined under "CLUTCH AND CONTROLS", page 40-5-3.

Refer to Section 50, Group 30 and remove hydraulic brake valve from reverser housing.

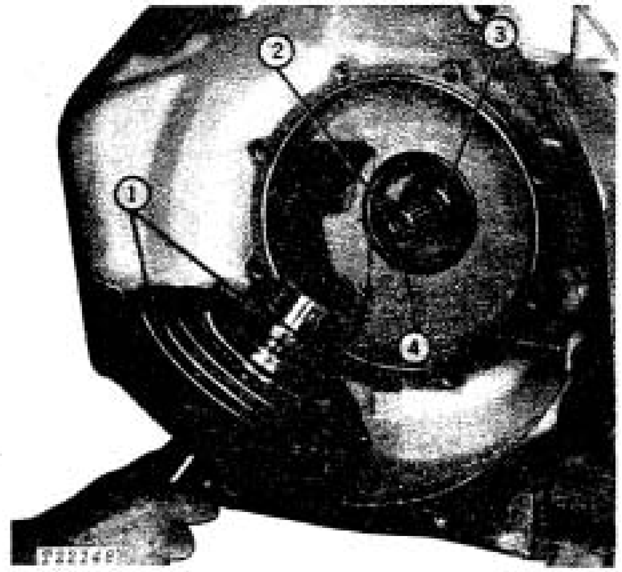
Disconnect linkage from reverser control valve and remove valve. See Section 50, Group 15. Remove clutch control valve plate and remove oil lines from clutch housing.

Forward Clutch Assembly

Remove throw-out bearing support and slide clutch pack from clutch housing (Fig. 1).

Transmission Oil Pump

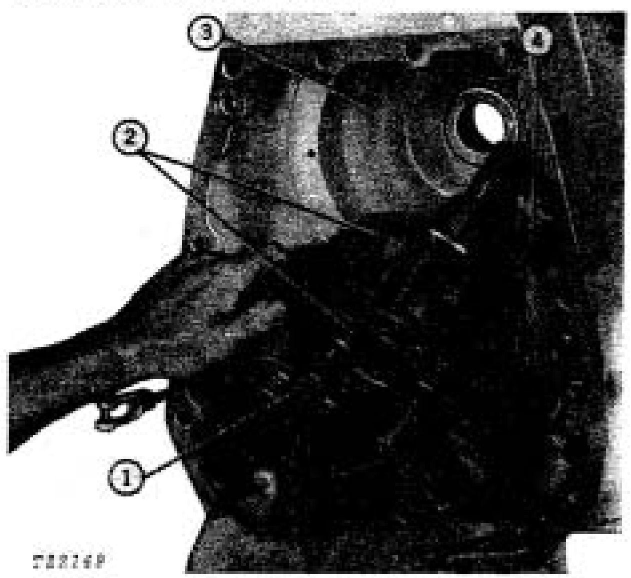
If transmission oil pump requires servicing it may be removed from reverse brake assembly or it may be removed with brake assembly.



1—Forward Clutch Pack 2—Clutch Shaft 3—Powershaft Drive Shaft 4—Oil Sleeve

Fig. 1-Forward Clutch Pack

Reverse Brake Assembly



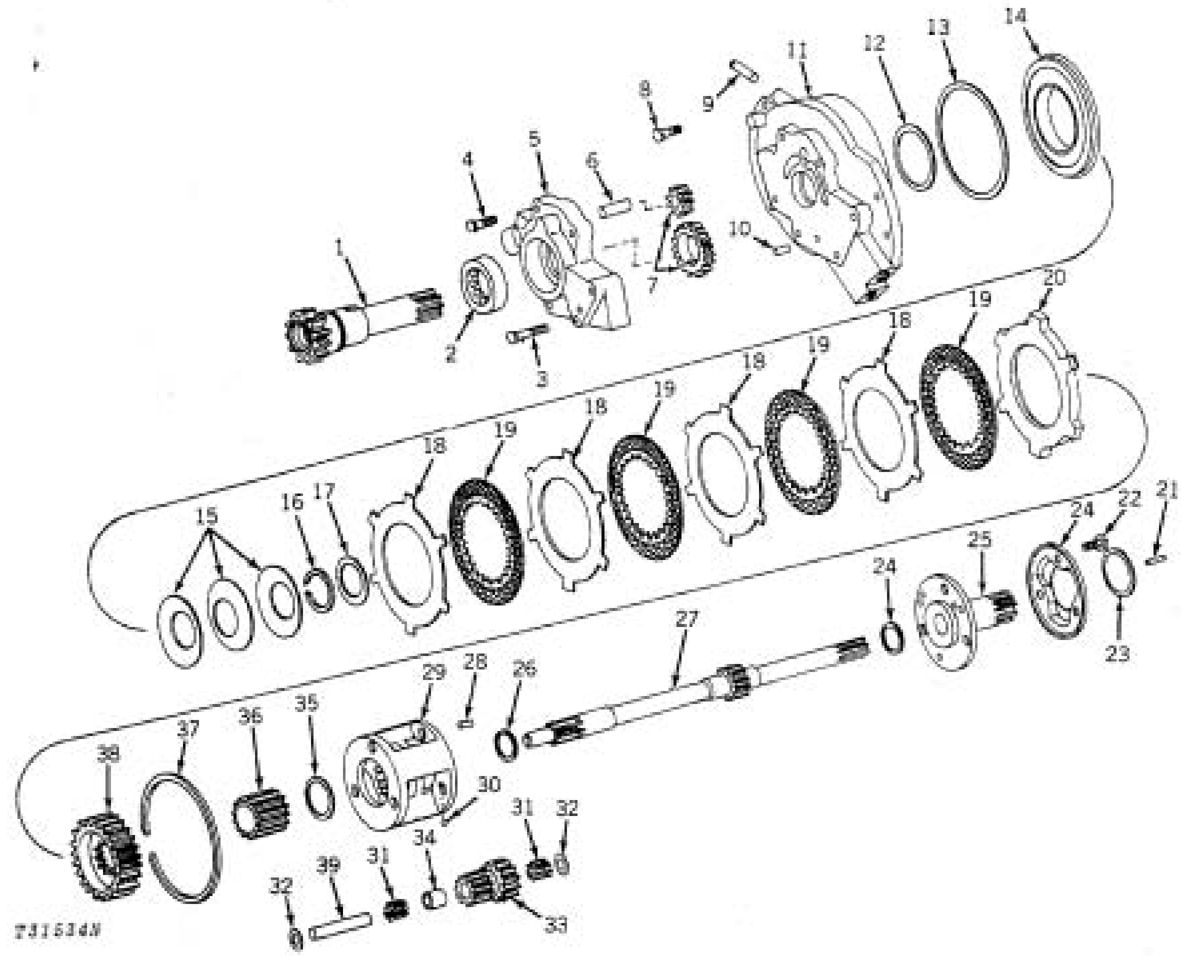
1—Transmission Oil Pump 2—Reverse Brake Assembly 3—Thrust Washer 4—Forward Clutch Lube Line

Fig. 2-Reverser Brake Assembly

Slide reverse brake assembly from clutch housing (Fig. 2).

REPAIR

Reverser Brake Assembly

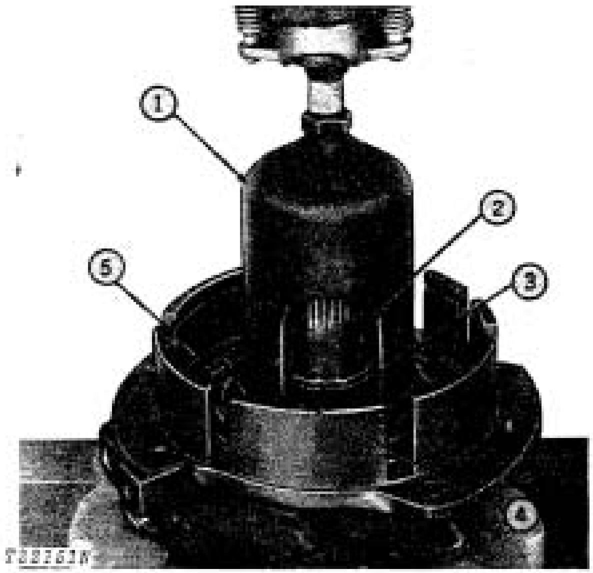


1—Powershaft Drive Shaft
2—Roller Bearing
3—Special Cap Screw (5 used)
4—Cap Screw (7 used)
5—Oil Pump Body
6—Pin
7—Oil Pump Gears
8—Cap Screw (4 used)
9—High Speed Lockout Pivot Pin
10—Dowel Pin (3 used)
11—Reverse Brake Housing
12—Piston Sealing Ring (inner)
13—Piston Sealing Ring (outer)
14—Reverser Brake Piston
15—Spring Washers (3 used)
16—Snap Ring
17—Special Thrust Washer
18—Separator Plate (4 used)
19—Brake Disk (4 used)
20—Backing Plate
21—Spring Pin
22—Cap Screw (3 used)
23—Special Thrust Washer
24—Baffle
25—Planet Pinion Carrier Shaft
26—Special Thrust Washer (2 used)
27—Clutch Shaft
28—Dowel Pin
29—Planet Pinion Carrier
30—Steel Ball (3 used)
31—Roller Bearing (132 used)
32—Special Thrust Washer (6 used)
33—Planet Pinion (Set of 3)
34—Spacer (3 used)
35—Special Thrust Washer
36—Pinion
37—Snap Ring
38—Clutch Hub
39—Planet Pinion Shaft (3 used)

Fig. 3-Transmission Oil Pump and Reverse Brake Assembly

Refer to Figure 3 for parts identification and disassemble reverse brake assembly.

The snap ring holding the spring washer pack in reverse brake housing must be removed in order to free piston from reverse brake housing. Place an AM236T Oil Filter Cover with one side cut out over washer pack and press down on washers until snap ring can be removed (Fig. 4). Then release pressure slowly. **BE CAREFUL.**



1—Oil Filter Cover
2—Cut Out Portion
3—Snap Ring
4—Spring Washer Pack
5—Piston

Fig. 4-Removing Reverse Brake Piston

The planet pinions rotate in planet pinion carrier on shafts supported by roller bearings located radially around inner circumference on each end of pinions. To remove pinions, push planet pinion shafts a slight distance from carrier and remove small locking balls at end of each shaft. Be careful, do not lose these balls.

Pull shafts completely from carrier and remove planet pinions, roller bearings, and spacers.

Use care not to lose roller bearings located radially on each end of planet pinions. There are 44 rollers used in each planet pinion assembly or a total of 132 rollers for the pinion set.

Check three spring washers for damage or flattened condition. With concave side of washer face down on a flat surface, approximate free height should be to specifications (reverse brake release, 0.143 inch [3.556 mm] and forward clutch release, 0.183 inch [4.572 mm]).

Inspect bronze clutch disks and steel separator plates for wear. Examine facings on disks to see that grooved pattern has not been worn or chipped off. Also check internal teeth for breakage.

The separator plates should have a slight "wavy" configuration. Do not attempt to flatten these plates.

If replacement of planet pinion is necessary, replace with a set of 3 pinions as planet pinions are matched.

Assemble reverse brake assembly using Figure 3, for parts identification.

Be sure sealing rings on piston are not cut during piston installation. Apply a generous coat of same type of oil used in the transmission to sealing rings before installation.

To depress washer pack, use AM236T Oil Filter Cover (with one side cut out) and install snap ring. See Figure 4. **BE CAREFUL.**

To install the 44 rollers used in each planet pinion, apply a generous coating of grease to rollers to keep them in place during assembly.

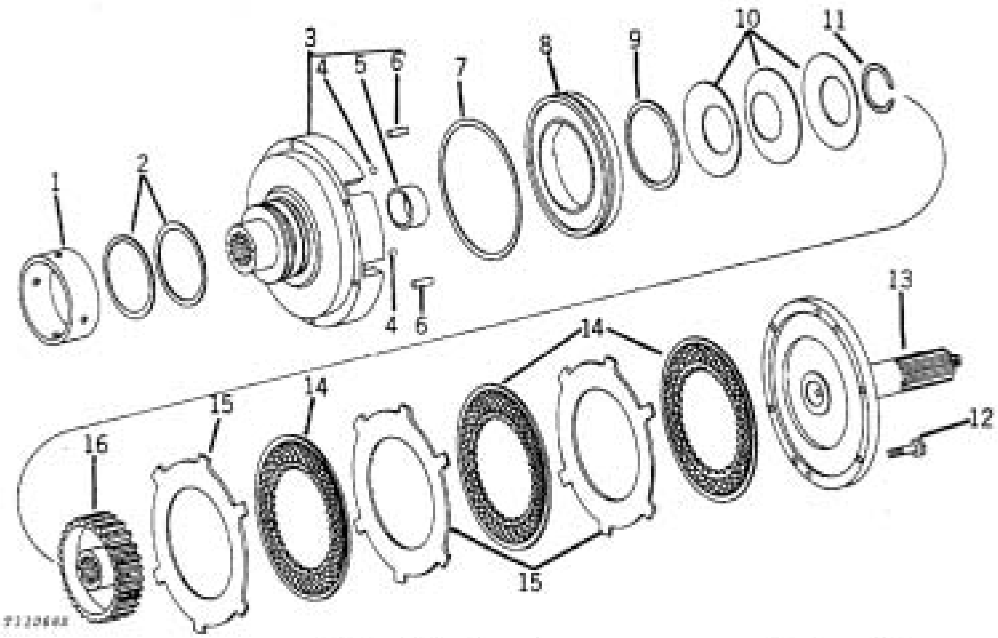
Place planet pinion with roller bearing in carrier (large gear to front of carrier as installed in tractor). Note number etched on large gear of pinion and numbers on clutch shaft gear. Match number on pinion with number on clutch shaft gear to be sure of proper timing.

Position a special washer on each end of planet pinion and install planet pinion shaft (end with hole to front). Push shaft in far enough so that locking ball hole is just exposed. Insert ball in hole and push shaft flush with outside of planet pinion carrier. Repeat the process on the other two planet pinions.

Install planet pinion carrier shaft on carrier. Install baffle. Tighten cap screws.

Place planet sun pinion in reverse brake hub and assemble planetary gear set to reverse brake housing.

Forward Clutch Pack



1—Sleeve
2—Sealing Ring (2 used)
3—Drum Assembly
4—Ball (2 used)
5—Bushing
6—Dowel Pin (2 used)
7—Sealing Ring
8—Clutch Piston
9—Sealing Ring
10—Spring (3 used)
11—Snap Ring
12—Cap Screw (6 used)
13—Clutch Drive Shaft
14—Clutch Drive Disk (3 used)
15—Separator Plate (3 used)
16—Clutch Hub

Fig. 5-Forward Clutch Assembly

Refer to Figure 5 for parts identification and disassemble forward clutch assembly.

Release spring washer pack and remove piston with a press and an AM326T Oil Filter Cover as described under "Reverse Brake Assembly."

Examine bushing in hub for wear. Drive in new bushing until top is flush with bottom of chamfer in bushing bore. Open end of bushing oil groove must face inward.

Inspect steel separator plates and bronze clutch disks for wear. Examine grooved pattern on facings of disk to see that is has not been worn or chipped off.

The separator plates should have a slight "wavy" configuration. Do not attempt to flatten these plates.

Liberally grease all sealing rings to facilitate installation. Be sure sealing rings do not become twisted or damaged when installing piston.

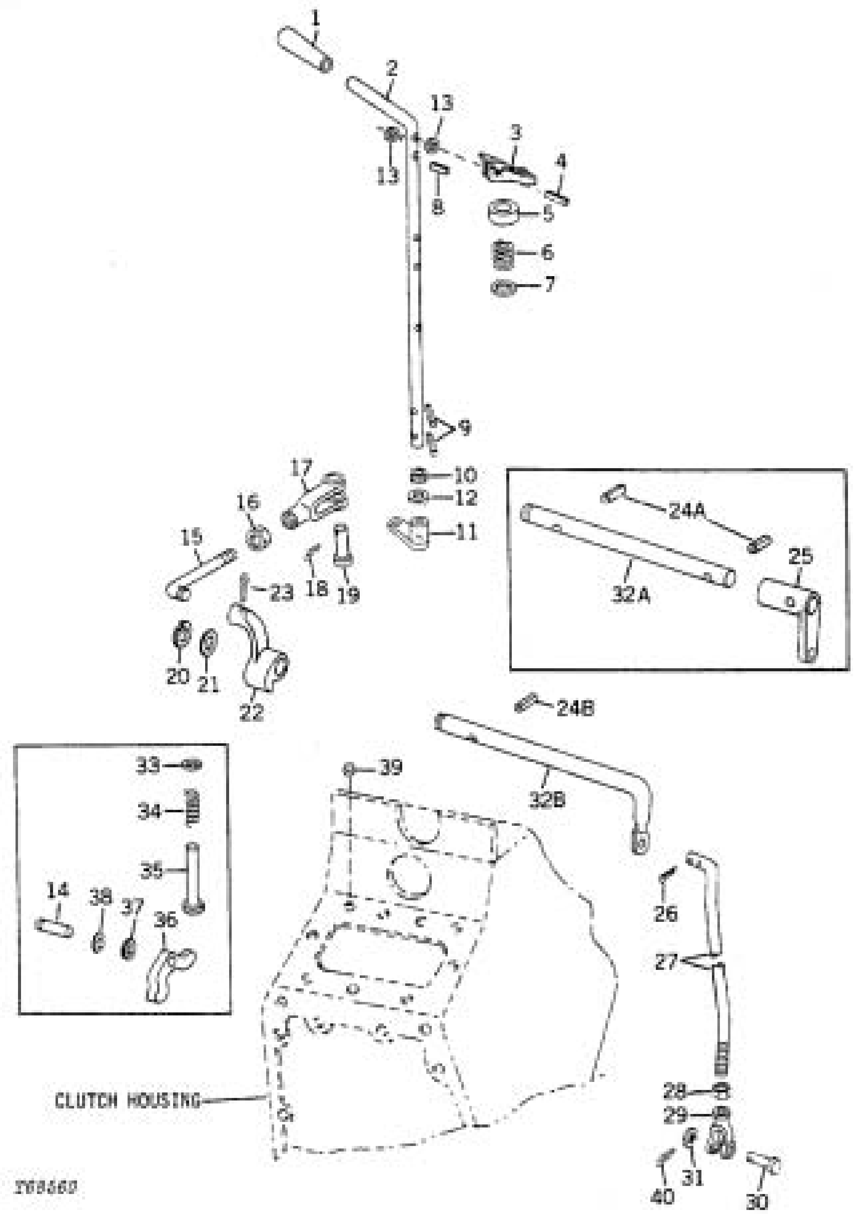
Install one spring washer (concave side down) against piston. Place other two spring washers, concave side to concave side, against the first washer.

Using a press and AM236T Oil Filter Cover, depress spring washer pack until snap ring can be seated.

Place clutch hub over spring pack and starting with a tanged separator disk and alternating with a clutch facing, assemble the clutch pack (consisting of three separator plates and three clutch disks).

Install clutch drive shaft to drum. Tighten cap screws.

Reverser Control Lever and Linkage



1—Knob
2—Transmission Control Lever
3—Neutral Latch
4—Spring Pin
5—Washer
6—Spring
7—Washer
8—Spring Pin
9—Spring Pin (2 used)
10—Bushing
11—Control Arm
12—Washer
13—Washer (Use as required) (-268782)
14—Pin (-277181)
15 —Link
16 —Nut
17 —Adjustable Yoke
18 —Cotter Pin
19 —Pin
20 —Retaining Ring
21 —Washer
22 —Control Shaft Arm
23 —Cotter Pin
24A—Spring Pin (2 used) (-240680)
24B—Spring Pin (240681-)
25 —Control Lever Rod Upper Arm (-240680)
26 —Cotter Pin (2 used)
27 —Control Lever Rod
28 —Jam Nut
29 —Yoke
30 —Headed Pin
31 —Washer
32A—Shaft (-240680)
32B—Shaft
33 —O-Ring (-277181)
34 —Spring (-277181)
35 —Headed Pin (-277181)
36 —High-Speed Lockout Arm (-277181)
37 —Washer (-277181)
38 —Snap Ring (-277181)
39 —Plug (277182-)
40 —Cotter Pin

Fig. 6-Reverser Control Lever and Linkage

Inspect control linkage parts for damaged or worn condition.

Check control lever shaft for twisted, broken or otherwise damaged condition.

Examine bushings in tractor cowl assembly for wear or damage. Install new bushing in cowl with larger diameter side facing upward.

Assembly

Place one washer (13, Fig. 6) on each side of transmission control lever between lever and neutral latch (3). Add washers as required to provide minimum clearance without binding.

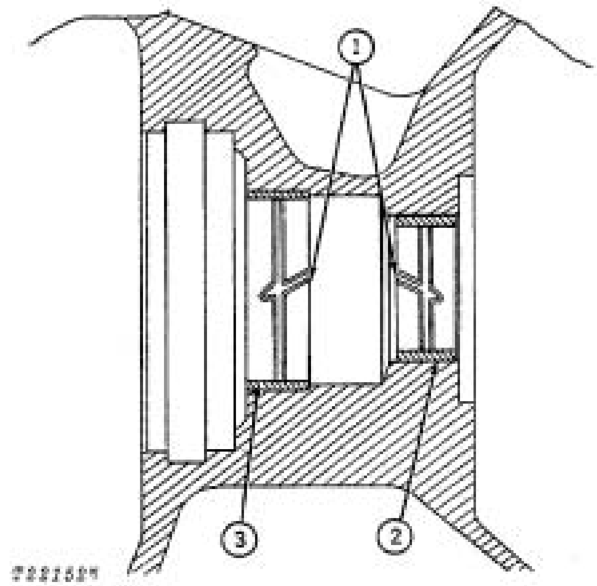
With control lever fixed to control lever shaft, insert shaft through top bushing in dash until it bottoms. Install control lever arm to shaft with spring pin. Spring pin may be easily installed if control lever is rotated until it points to rear of dash.

Reposition control lever and connect control lever arm to control shaft arm.

Reverser Clutch Housing

Check reverser clutch housing for cracks or other damage.

Inspect bushings in center bore of clutch housing. Press in new bushings with open ends of oil grooves toward center of clutch housing (Fig. 7).



1—Oil Grooves
2—Reverse Brake Bushing
3—Forward Clutch Bushing

Fig. 7-Forward Clutch and Reverse Brake Bushing

INSTALLATION

To install reverser components in clutch housing reverse removal procedure.

To install clutch housing with reverse unit in tractor reverse removal procedure.

For reverser hydraulics refer to Section 50, Group 15.

Group 20
PTO SYSTEMS

CONTINUOUS-RUNNING PTO

GENERAL INFORMATION

The continuous-running PTO is a single 540 rpm. A mid 1000 rpm powershaft is available.

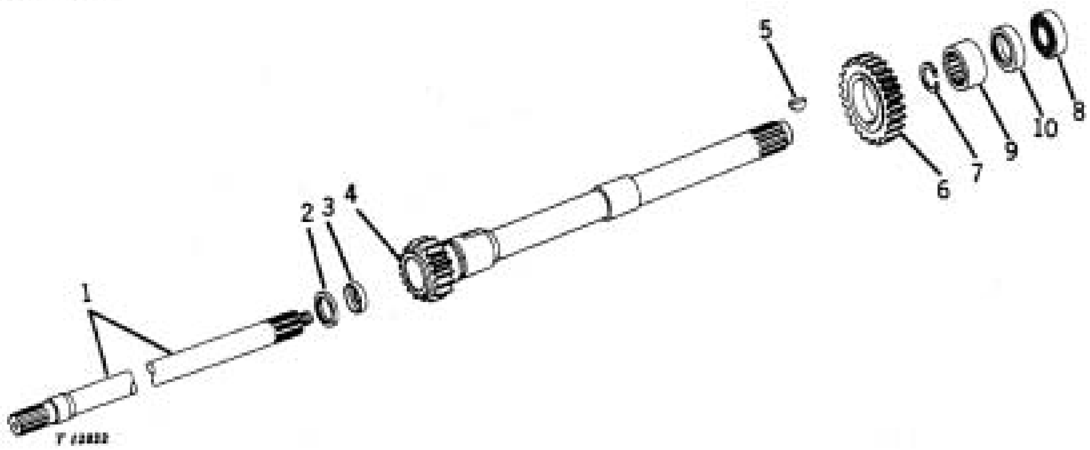
The PTO powershaft is located in the lower portion of the transmission case. Its operation is independent of the transmission and differential. The PTO has its own clutch and gear train, and runs only when the PTO clutch is engaged.

The PTO is equipped with selector levers to disconnect the rear or mid powershafts when the shafts are not in use or when independent operation of the shafts is desired.

Both selector levers are located on the left side of the tractor; the mid PTO selector lever is located just forward of the rear PTO lever.

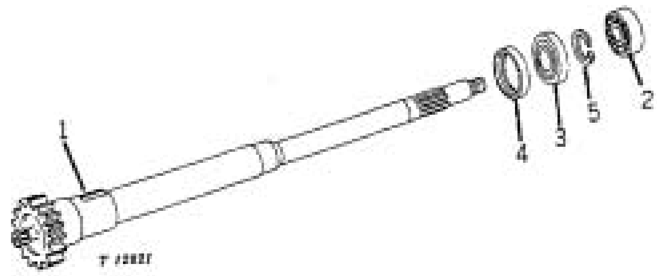
NOTE: On tractors with reverser, all PTO options are continuous-running.

A dual stage clutch is used to provide continuous PTO operation on tractors not equipped with reverser. On tractors with reverser, a single stage clutch is used to provide continuous PTO operation.



1—Clutch Shaft
2—Oil Seal
3—Pilot
4—Powershaft Clutch Shaft
5—Woodruff Key
6—Drive Gear (1000 rpm)
7—Snap Ring
8—Ball Bearing
9—Needle Bearing
10—Oil Seal

Fig. 1-Clutch Shaft, Continuous-Driven PTO (Units without Reverser)



1—Clutch Shaft
2—Ball Bearing
3—Oil Seal
4—Pilot
5—Snap Ring

Fig. 2-Clutch Shaft (No PTO) (Without Reverser)

REMOVAL

To remove continuous-running PTO, drain transmission.

Move PTO selector lever to "OFF" position.

Remove cap screws securing PTO quill to rear of transmission case.

Pull PTO powershaft out rear of transmission. Be careful not to pull disconnect collar off of front drive shaft.

To service the PTO drive shaft and gear, separate the tractor between the transmission case and the clutch housing. Refer to Section 40, Group 5.

Remove PTO drive gears from drive shaft.

Install rear PTO powershaft (if removed). Shift the PTO lever to the "ON" position. This will prevent shifter collar from falling into case as drive shaft is removed.

Pull drive shaft out front of transmission case.

To service the PTO disconnect, remove rockshaft housing from transmission as instructed in Section 50, Group 55.

Remove countershaft and low and high range shifter shafts from the transmission. Refer to Section 40, Group 10.

Holding shifter collar, remove PTO drive shaft from transmission (if not removed). Remove shifter collar.

Remove set screw securing shifter to shaft.

Slide shaft out front of transmission case and remove shifter from transmission case.

Remove pin securing shifter arm to shifter lever. Remove lever and arm from transmission case.

To remove mid PTO, remove retaining ring from disconnect shaft and pull shifter lever out left side of clutch housing.

Remove roll pin securing shifter shaft to yoke and pull shaft with coupling out of quill.

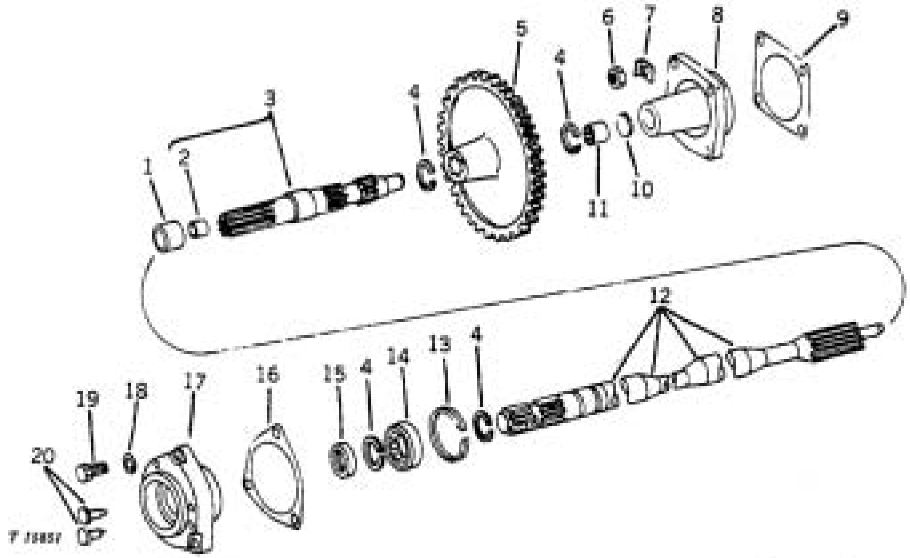
Use care not to damage O-ring packing on disconnect shaft when removing lever from clutch housing.

Remove yoke with disconnect collar from quill and powershaft. Be careful not to lose detent ball and spring.

To remove mid-PTO powershaft, remove snap ring in front of bearing. Using a plastic hammer drive powershaft from quill.

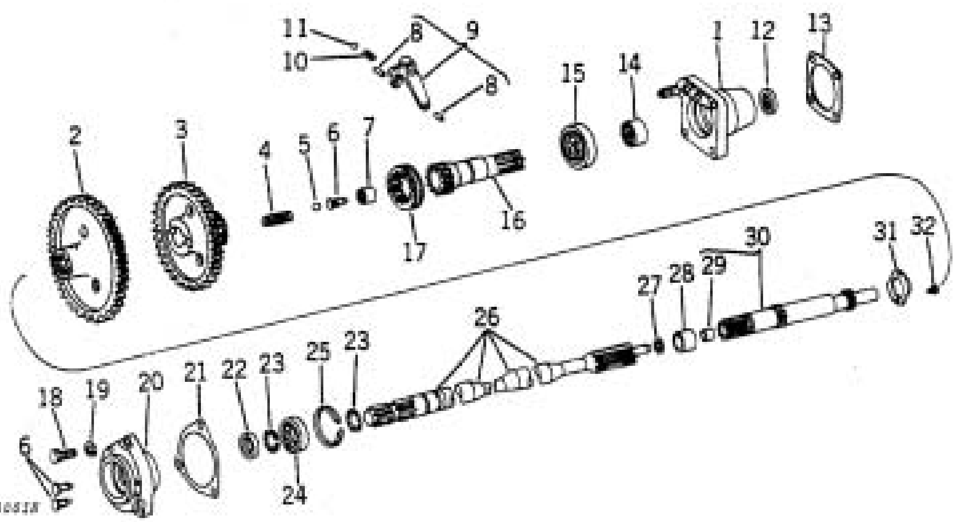
Bend up lock tabs and remove hex. nuts securing mid-PTO quill to clutch housing. Using a plastic hammer, drive quill from clutch housing.

REPAIR



1—Bushing
2—Bushing
3—Drive Shaft with Bushing
4—Snap Ring (4 used)
5—Driven Gear (540 rpm)
6—Nut (4 used)
7—Lock Plate (4 used)
8—Mid Cover
9—Gasket
10—Thrust Washer
11—Needle Bearing
12—Powershaft
13—Snap Ring
14—Ball Bearing
15—Oil Seal
16—Gasket
17—Rear Quill
18—Lock Washer (3 used)
19—Cap Screw (3 used)
20—Drive Screw (2 used)

Fig. 3-Continuous 540-RPM Rear PTO

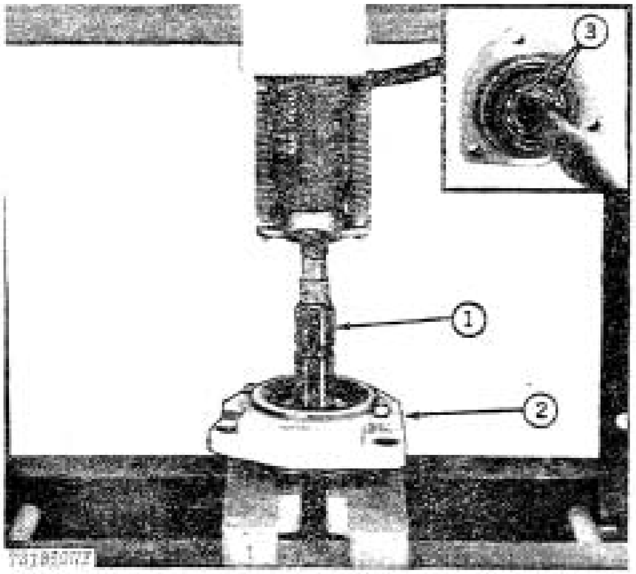


1—Quill
2—Driven Gear (540-RPM PTO)
3—Driven Gear (1000-RPM PTO)
4—Spring
5—Ball
6—Special Drive Screw (3 used)
7—Needle Bearing
8—Special Dowel Pin (2 used)
9—Yoke
10—Spring
11—Ball
12—Oil Seal
13—Gasket
14—Needle Bearing
15—Ball Bearing
16—Mid Powershaft
17—Collar
18—Cap Screw (3 used)
19—Lock Washer (3 used)
20—Rear Quill
21—Gasket
22—Oil Seal
23—Snap Ring (2 used)
24—Ball Bearing
25—Snap Ring
26—Rear Powershaft
27—Thrust Washer
28—Bushing
29—Bushing
30—Drive Shaft
31—Thrust Washer
32—Drive Screw (2 used)

Fig. 4-Gears and Shafts (With Continuous 540-RPM and 1000 Mid PTO)

Inspect powershaft for wear or damage. Inspect bearing in powershaft quill for damage.

To replace powershaft or bearing, remove snap rings and press off old bearing (Fig. 5). Press on new bearing until snap rings fit in grooves.



1—Power Shaft
2—Quill
3—Snap Ring

Fig. 5-Pressing Powershaft from Quill

Inspect powershaft quill for damage. Check for evidence of oil leakage around oil seal. If necessary, remove old seal and press new seal (with lips of seal facing driver) to bottom of bore in quill then coat sealing lips with John Deere Multi-Purpose Lubricant or an equivalent.

Protect sealing lips of oil seal with a suitable thin sleeve when installing rear powershaft.

Inspect PTO drive gear and shaft for wear or damage. Check drive gear inner bushing for wear and replace if necessary.

Examine drive shaft bushing in front of transmission case for wear and replace if necessary.

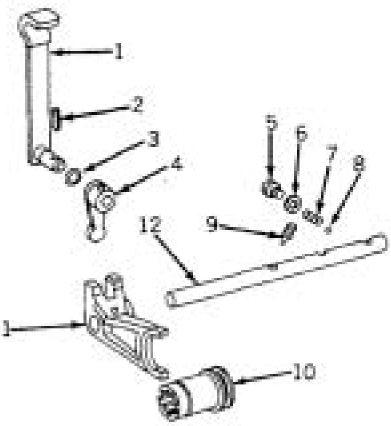
Check spring in drive shaft for worn or broken coils and replace if necessary.

Inspect mid PTO powershaft for damage or wear on splines and drive teeth. Check bearing on shaft and needle bearing inside shaft for damage and replace if necessary.

Inspect needle bearing in quill for roughness or wear. Examine oil seal in quill for damage and replace if necessary.

Examine disconnect collar, yoke and lever for wear or damage and replace if necessary.

Inspect mid PTO driven gear on front of transmission for damage or broken teeth. Check driven gear inner bushings for wear. If worn, replace driven gear.



1—Shift Lever
2—Groove Pin
3—O-Ring
4—Shifter Arm
5—Cap Screw
6—Special Washer
7—Spring
8—Ball
9—Special Set Screw
10—Shift Collar
11—Shifter
12—Shifter Shaft

Fig. 6-PTO Disconnect

Inspect PTO disconnect shaft and yoke for damage and replace if necessary.

Check splines on disconnect collar for damage and replace if necessary.

INSTALLATION

Insert splined end of drive shaft in from front of transmission. Reach down through front transmission compartment to align splines with disconnect collar.

Position PTO drive gear, with long hub inward, over drive shaft. Also install mid PTO drive gear (if equipped) with long hub outward.

Install PTO drive shaft front quill in clutch housing (if removed).

If tractor is equipped with a mid PTO, install mid PTO quill assembly in clutch housing and secure with hex. nuts and lock plates.

Insert mid PTO powershaft with bearing in quill, using care not to damage oil seal.

Insert detent ball and spring in yoke and position yoke with collar over power shaft and quill.

Insert shifter shaft with coupling through quill and yoke. Align holes in shaft and yoke and secure with roll pin.

Install disconnect lever shaft with O-ring packing in from left side of clutch housing. Install plain washer and retaining ring on shaft inside clutch housing and align shaft with shifter shaft coupling. Position washer and retaining ring against inside of clutch housing.

Install countershaft and low and high range shifter shafts in transmission as instructed in Section 40, Group 10.

Join clutch housing to transmission case as instructed in Section 40, Group 5.

Position PTO disconnect shifter in transmission and slide shifter shaft in from front of transmission through shifter and into rear bore.

Align hole in shifter with hole in shaft and secure shifter with set screw.

Insert shifter lever in left side of transmission case and secure shifter arm on shifter lever inside transmission case with pin.

Install rockshaft housing on transmission as instructed in Section 50, Group 55.

Insert PTO powershaft in from rear of transmission case, turning shaft to align splines with disconnect collar.

Secure PTO powershaft quill to rear of transmission with attaching cap screws.

Install PTO shield and guard (if equipped) to rear of tractor.

Join the clutch housing to the transmission case. Refer to Section 40, group 5.

INDEPENDENT PTO

GENERAL INFORMATION

The independent PTO option is a single 540 rpm PTO.

The PTO gear train is located in the lower portion of the transmission case. The PTO clutch shaft is driven by the engine clutch pressure plate (single stage) and turns the PTO clutch drum whenever the engine is running. Clutch shaft operation is independent of the transmission.

Operation of the PTO clutch (mounted ahead of transmission countershaft bearing support) is controlled by a control valve (Section 50, Group 20) located at the top of the clutch housing in the transmission shifter cover.

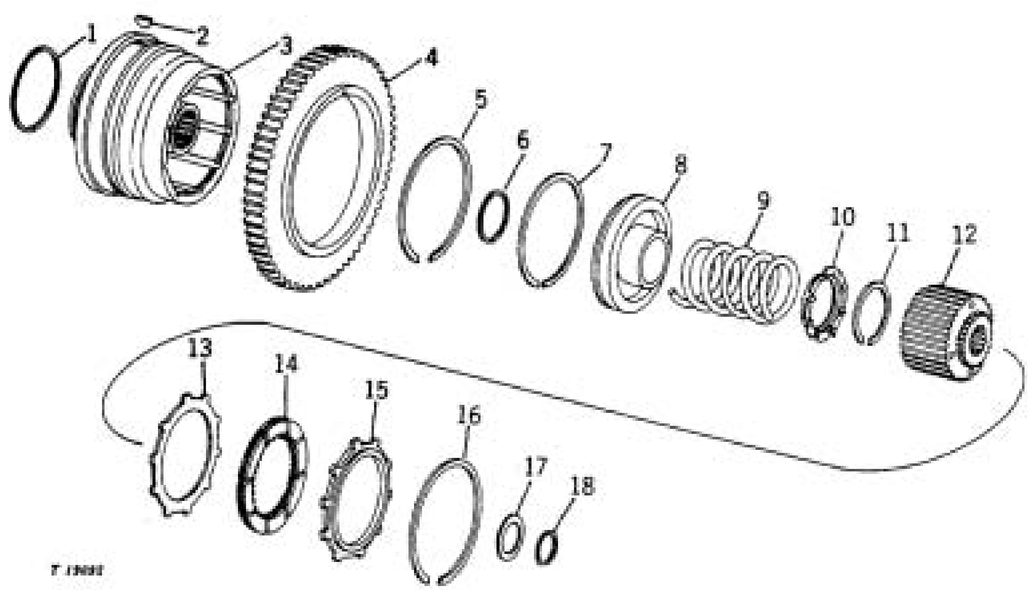
REMOVAL

Drain transmission oil and remove rear PTO quill. Pull PTO drive gear (if equipped) out rear of transmission. Remove powershaft as follows:

Remove rockshaft housing. Refer to Section 50, Group 55. Hold coupling between powershaft and drive shaft in place with the aid of a long thin screwdriver. Pull PTO powershaft out rear of tractor.

Remove countershaft assembly and inspect all parts for damage or wear.

To service the PTO clutch assembly, separate the tractor between the transmission case and the clutch housing. Refer to Section 40, Group 5.



1—Sealing Ring (2 used)
2—Woodruff Key
3—Clutch Drum
4—Clutch Gear
5—Snap Ring
6—Packing
7—Sealing Ring
8—Piston
9—Spring
10—Retainer
11—Snap Ring
12—Clutch Hub
13—Separator Plate (8 used)
14—Disk (8 used)
15—Plate
16—Snap Ring
17—Thrust Washer
18—Snap Ring

Fig. 7-PTO Clutch Drum and Disks

Repair

Before removing PTO shift lever assembly from transmission top cover, place lever in the engaged position. When removed, do not move lever assembly, or detent balls and springs will fall out.

To remove clutch pack, remove front snap ring securing clutch pack assembly to drive shaft. Pull clutch pack assembly from unit leaving PTO drive shaft in place to keep coupler from falling into transmission.

To remove clutch piston, compress loaded spring (9, Fig. 7) and remove snap ring (11).

Note the number of separator plates and disks for correct assembly. When assembling clutch pack, start with a separator plate against piston.

Heat drive gear to 360°F. [182°C] before pressing on PTO clutch drum. Install gear with offset toward small end of drum.

Inspect all parts for damage or wear. Assemble and install clutch assembly.

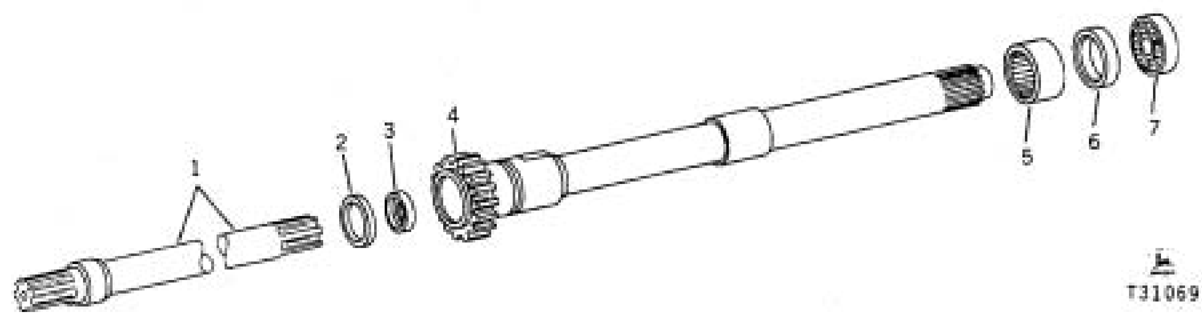
Coat sealing lips of clutch shaft oil seal (2, Fig. 8) with multi-purpose grease. Press into powershaft clutch shaft (4) with sealing lips facing driver and flush with finished edge of bore.

Protect sealing lips of clutch shaft oil seal with suitable thin sleeve when installing clutch shaft.

Press rear powershaft quill oil seal (17, Fig. 9) in quill with spring side of seal facing driver. Coat sealing lips with multi-purpose grease.

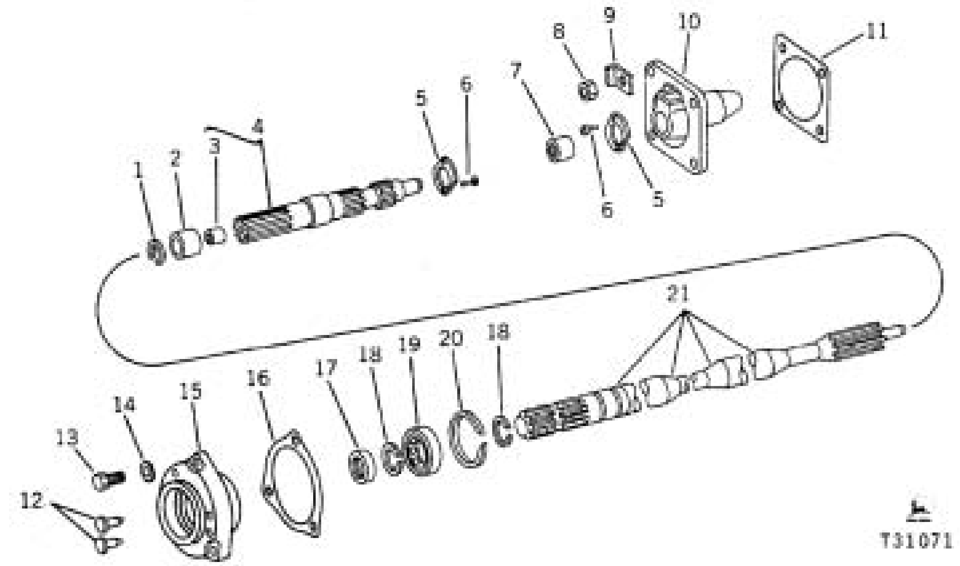
Protect oil seal sealing lips with a suitable thin sleeve when installing rear power shaft.

Press the clutch shaft pilot (3, Fig. 8) in powershaft clutch shaft with cup side facing bottom of bore.



1—Clutch Shaft
2—Oil Seal
3—Pilot
4—Powershaft Clutch Shaft
5—Needle Bearing
6—Oil Seal
7—Ball Bearing

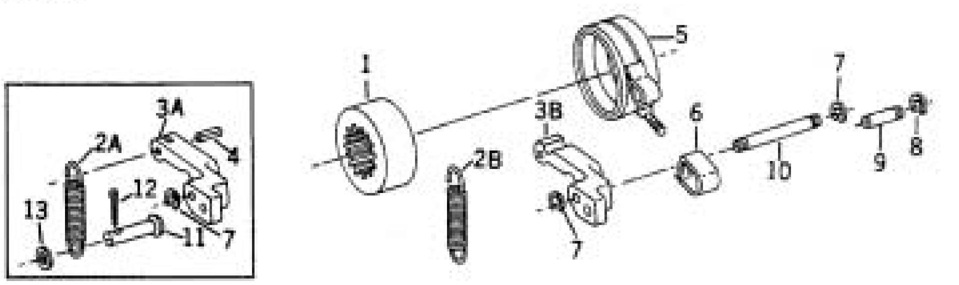
Fig. 8-Clutch Shafts and Pilot



1—Thrust Washer
2—Bushing
3—Bushing
4—Drive Shaft
5—Thrust Washer (2 used)
6—Drive Screw (4 used)
7—Needle Bearing
8—Nut (4 used)
9—Lock Plate (4 used)
10—Cover
11—Gasket
12—Special Drive Screw (3 used)
13—Cap Screw (3 used)
14—Lock Washer (3 used)
15—Rear Quill
16—Gasket
17—Oil Seal
18—Snap Ring (2 used)
19—Ball Bearing
20—Snap Ring
21—Rear Powershaft

Fig. 9-Rear PTO Gears and Shafts

PTO Brake Assembly



1 —Brake Drum
2A—Spring (-260712)
2B—Spring (260713-)
3A—Brake Operating Lever (-260712)
3B—Brake Operating Lever (260713-)
4 —Spring Pin (-260712)
5 —Brake Band With Lining
6—PTO Brake Loop
7—Retaining Ring (2 used)
8—Retaining Ring
9—Special Pin
10—Guide
11—Special Pin (-260712)
12—Cotter Pin (-260712)
13—Washer (-260712)

Fig. 10-PTO Brake Parts

INSTALLATION

Install parts in transmission as removed.

Inspect brake assembly for wear or damage. Replace parts as necessary. Assemble and install brake assembly.

Install rockshaft housing. Refer to Section 50, Group 55.

Join clutch housing to transmission case. Refer to Section 40, Group 5.

To adjust PTO brake, refer to Section 70, Group 20.

Group 25
DIFFERENTIAL AND PARKING BRAKE

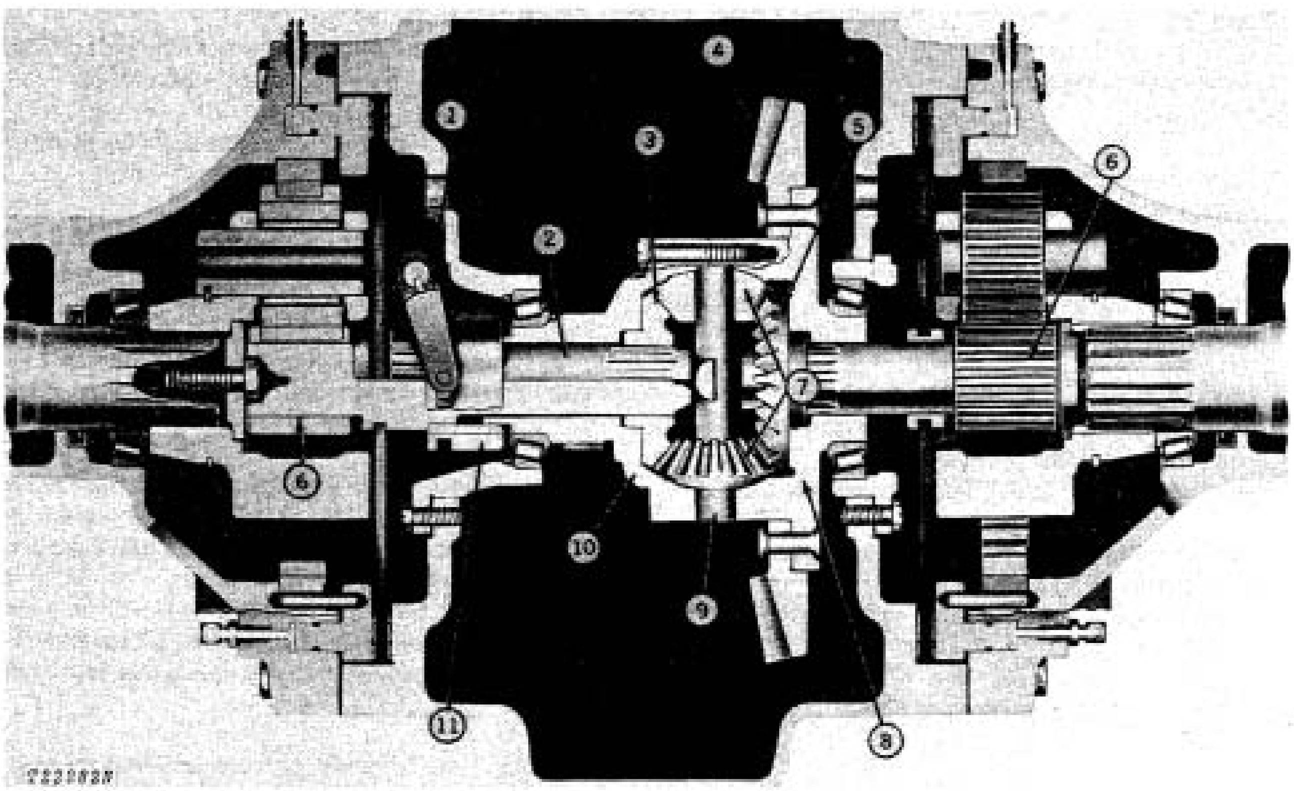
GENERAL INFORMATION

The differential is a spiral bevel gear assembly.

It is located in the rear compartment of the one-piece transmission and differential case.

The assembly is equipped with pedal-operated differential lock which consists of a collar to connect the left bevel gear to the housing. This locks the gears and pinions within the housing, giving the effect of a solid rear axle.

The parking brake drum is located within the differential case and is splined to the left-hand differential housing.



1—Differential Lock Lever
2—Final Drive Shaft
3—Left Bevel Gear
4—Ring Gear
5—Right Bevel Gear
6—Sun Pinion
7—Bevel Pinions
8—Differential Hub
9—Bevel Pinion Shaft
10—Differential Hub Quill
11—Differential Lock Collar

Fig. 1-Differential Assembly with Differential Lock (Unit without parking brake shown)

REMOVAL

Block loader frame to prevent frame from dropping down.

Disconnect wire harness from fender lights of the connections.

Remove cap screws attaching fenders and ROPS to axle housing.

Drain transmission case. Securely block transmission.

Remove final drive as instructed in Section 40, Group 30.

Remove rockshaft housing as instructed in Section 50, Group 55.

Split tractor between clutch housing or reverser housing (if so equipped) as instructed in Section 40, Group 10.

NOTE: If tractor is equipped with a differential lock, lock assembly must be removed to service the differential.

Remove set screw securing differential lock pedal to shaft on left side of transmission case. Drive pedal forward off end of shaft. Remove key from shaft.

Hold differential lock yoke in place and drive shaft out towards rear of tractor. Remove plug from rear of transmission and Woodruff key from under yoke as shaft is driven out.

Note O-ring packing on shaft. Replace if damaged.

REPAIR

Remove rockshaft load control arm from transmission as instructed in Section 50, Group 50.

Lift up on differential assembly to relieve weight on bearing quills.

Remove bearing quills with shims from transmission case, keeping shims with their respective quills for correct assembly.

If the differential ring gear is no longer serviceable and must be replaced, also replace the differential drive shaft.

These parts are furnished as matched sets and are not available individually for replacement.

Remove cap screws (6, Fig. 2) securing differential housing cover to differential housing (14).

Remove bevel gears and bevel pinion shaft with bevel pinion from differential housing.

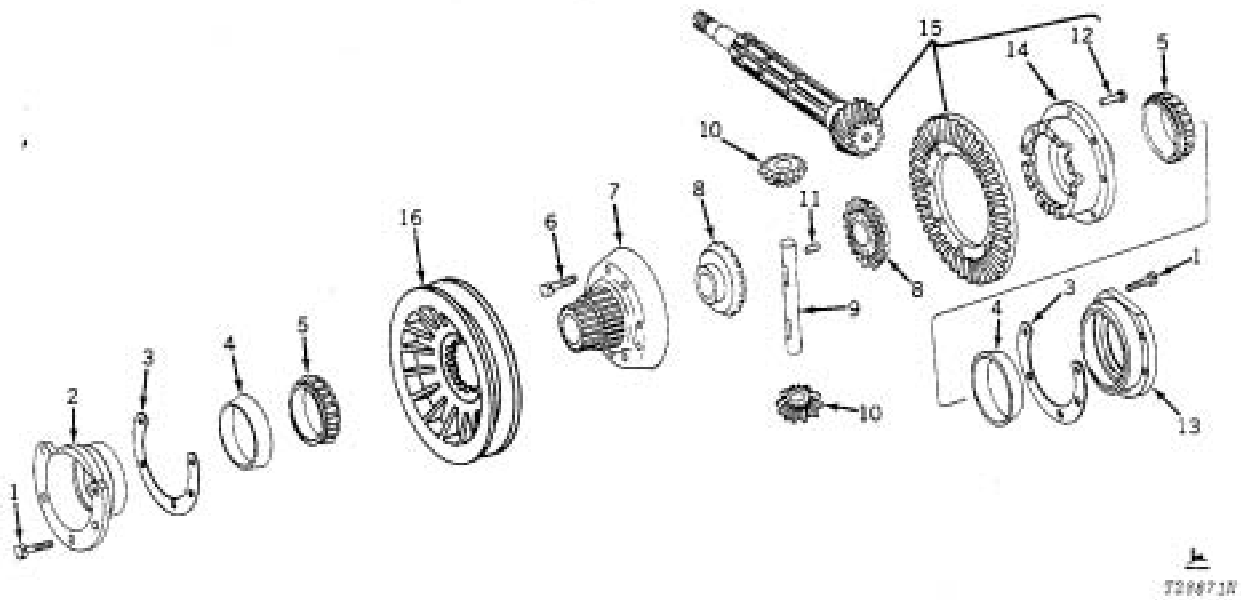
Examine bearing surfaces on the bevel gears. If the gears are worn or damaged, the bores in the differential housing and cover may also be damaged. Replace parts as needed.

Check bevel pinions and bevel pinion shafts for scoring or excessive wear. If any of these parts are found damaged or excessively worn, all matching parts should also be replaced.

All parts must be thoroughly cleaned before assembly. Coat parts with same type of oil used in the transmission.

Assembly bevel pinion shaft with differential bevel pinions and differential bevel gears into differential housing. Install differential housing cover and tighten attaching cap screws to 35 lb-ft [4.8 kg-m].

Lower differential assembly into correct position in transmission case.



1—Bolt (10 used)
2—Quill (L.H.)
3—Shim (as required)
4—Bearing Cup (2 used)
5—Bearing Cone (2 used)
6—Bolt (8 used)
7—Differential Housing (L.H.)
8—Differential Bevel Gear (2 used)
9—Bevel Pinion Shaft
10—Differential Bevel Pinion (2 used)
11—Dowel Pin
12—Rivet (8 used)
13—Quill (R.H.)
14—Differential Housing (R.H.)
15—Ring Gear and Pinion
16—Parking Brake Drum

Fig. 2-Differential Assembly

ADJUSTMENT

Differential Preload Adjustment

The differential assembly bearings must have a preload of 0.002 to 0.005 in. [0.05 to 0.13 mm].

To establish preload, proceed as follows:

Install bearing quills. Use shims under right bearing quill.

With clearance between the differential drive shaft and the ring gear, check the end play of the differential assembly with a dial indicator.

If necessary, add shims under the right bearing quill until a measurable amount of end play is obtained.

NOTE: To obtain a more accurate preload adjustment, introduced end play should not exceed 0.002 inch [0.05 mm].

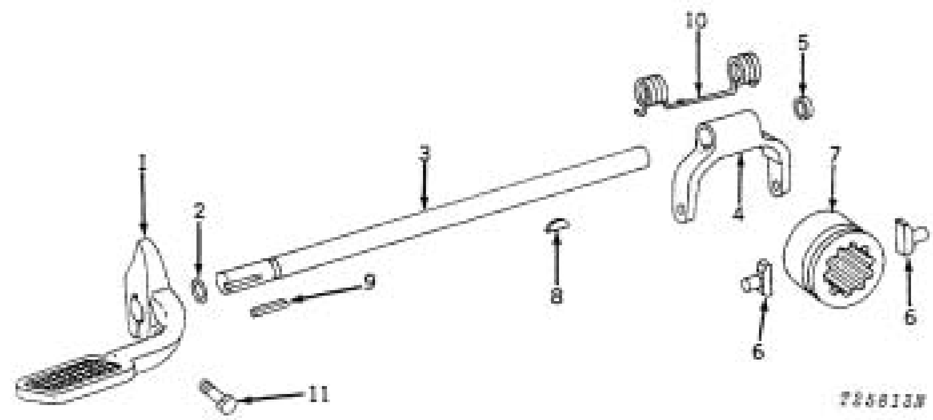
Record measured end play shown by the dial indicator. Take from the shim pack the thickness of shims equal to end play reading plus an additional 0.003 inch [0.07 mm] to give the desired preload of 0.002 to 0.005 inch [0.05 to 0.13 mm].

NOTE: At no time during preload adjustment should the differential drive shaft pinion be in contact with the ring gear. If adjustment cannot be made without gears touching, refer to Group 10 of this Section and remove differential drive shaft from transmission.

Differential Backlash Adjustment

After bearing preload has been established, mount the dial indicator to check the backlash between the differential drive shaft pinion and the ring gear.

Proper backlash is 0.006 to 0.008 inch [0.15 to 0.20 mm]. Adjust backlash by transferring differential bearing quill shims from one side of the case to the other.



1—Differential Lock Pedal
2—O-Ring
3—Shaft
4—Yoke
5—Plug
6—Shoe (2 used)
7—Collar
8—Woodruff Key
9—Key
10—Spring
11—Cap Screw

Fig. 3-Differential Lock Mechanism

To increase backlash, move shims from left to right. To decrease backlash, move shims from right to left.

IMPORTANT: If shims are removed from one bearing quill, the same shims must be added to the other bearing quill to maintain proper preload adjustment on differential bearings.

Apply AT30408 High Temperature Grease or an equivalent to differential lock shifter yoke shaft between O-ring groove and key slot before installing shaft.

Insert differential lock shaft with O-ring groove towards front of tractor, into rear of transmission case. Slide shaft through rear bore and position fork, spring, Woodruff key and O-ring on shaft.

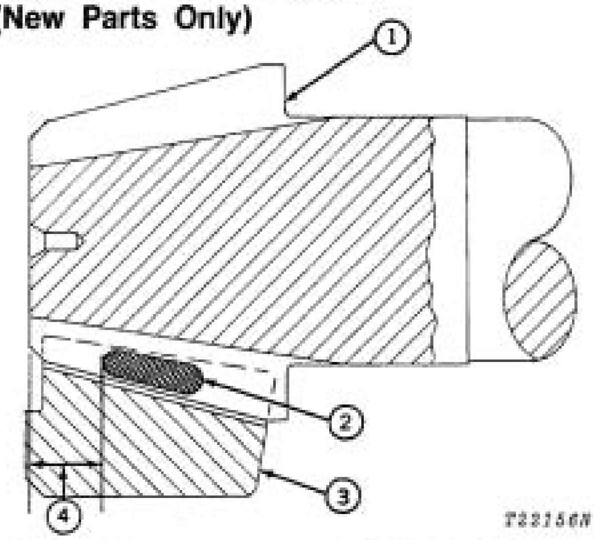
NOTE: Apply a thin coat of grease on O-ring before inserting in front bore.

Slide shaft into front bore and install lock lever with key. Secure pedal with set screw.

Check the tooth pattern of the differential spiral bevel gear with pinion (Fig. 4).

Bearing wear or cone point out of adjustment is indicated by improper tooth pattern.

Differential Spiral Bevel Gear and Pinion Tooth Pattern (New Parts Only)



1—Bevel Pinion
2—Tooth Bearing Pattern
3—Spiral Bevel Gear
4—0.120 to 0.360 in. [3.048 to 9.144 mm]

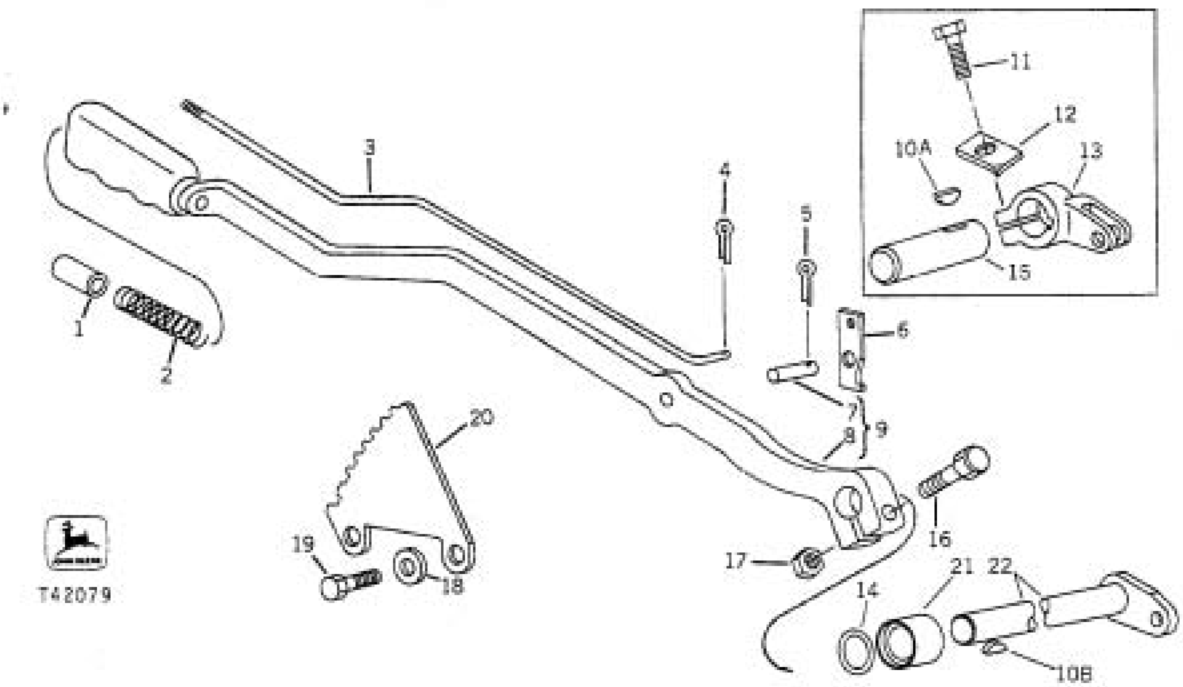
Fig. 4-Tooth Pattern

If cone point shim pack is readjusted, differential drive shaft preload and differential backlash must also be readjusted.

Install differential lock assembly.

Install both axle assemblies and rockshaft housing.

Parking Brake



1—Pawl Operating Rod Button	10A—Woodruff Key (2 used) (-230659)	16—Cap Screw
2—Spring		17—Nut
3—Pawl Operating Rod	10B—Woodruff Key (230660-)	18—Bushing (2 used)
4—Cotter Pin	11 —Cap Screw (-230659)	19—Cap Screw (2 used)
5—Cotter Pin	12 —Lock Plate (-230659)	20—Notched Quadrant
6—Pawl	13 —Brake Shaft Arm (-230659)	21—Spacer (230660-)
7—Brake Pin		22—Brake Shaft with Arm (230660-)
8—Brake Lever	14 —O-Ring	
9—Brake Lever with Pin	15 —Brake Shaft (-230659)	

Fig. 5-Parking Brake Lever and Linkage

Adjustment

Apply parking brake firmly five times to seat linkage.

If new linings or new brake band has been installed, burnish brake band as follows:

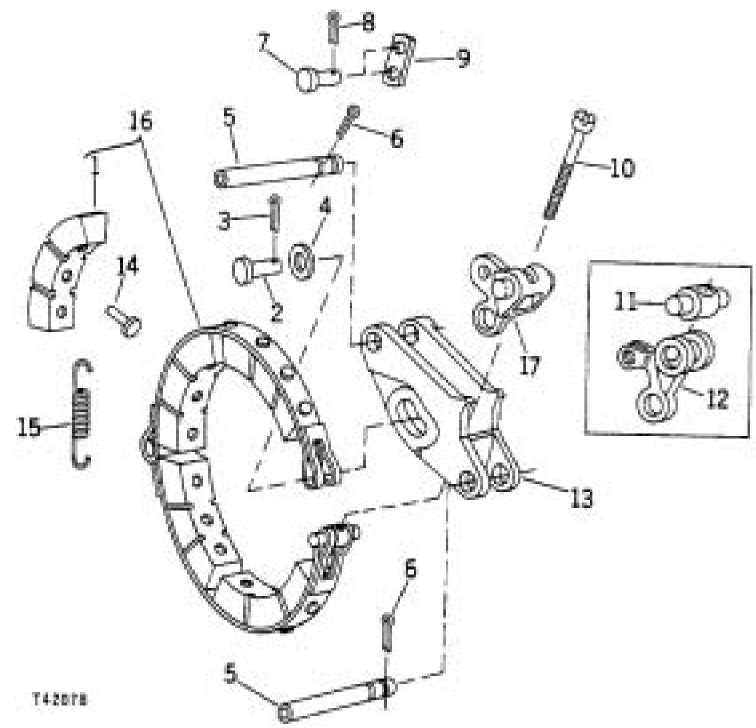
1. Apply parking brake firmly.
2. Place transmission in fourth gear forward.
3. Set engine speed at 1500 rpm.
4. Engage clutch and burnish brake band for 20 to 25 seconds.

Set brake lever so that brake pawl (6, Fig. 5) is in first notch above long tooth.

Tighten brake set screw (10, Fig. 6) with a wide blade screw driver by hand until it is not possible to turn the screw another complete half turn.

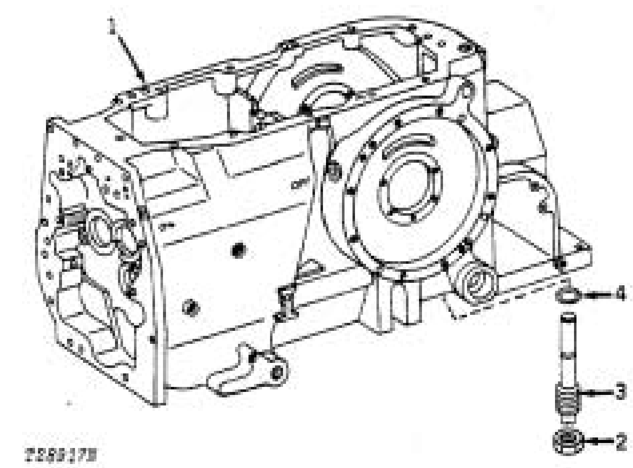
Final position of screw should have concave surface of screw head mating with surface of pivot pin (11) or brake band arm (17).

Loosen jam nut (2, Fig. 7) on bottom left side of transmission case. Tighten brake band stop screw (3) hand tight, then back off two turns. Tighten jam nut (2).



1—Brake Band Lining (4 used)
2—Headed Pin
3—Cotter Pin
4—Washer
5—Special Pin (2 used)
6—Cotter Pin (2 used)
7—Headed Pin (2 used)
8—Cotter Pin (2 used)
9—Bell Crank Link (-230659)
Link (2 used) (230660-)
10—Set Screw
11—Pivot Pin (-230659)
12—Brake Bell Crank (-230659)
13—Toggle Lever
14—Rivet (12 used)
15—Return Spring
16—Brake Band Assembly
17—Brake Band Arm (230660-)

Fig. 6-Brake Band, Lining and Linkage



1—Transmission Case
2—Jam Nut
3—Brake Band Stop Screw
4—O-Ring

Fig. 7-Brake Band Stop Adjustment

INSTALLATION

Join transmission housing to clutch housing (or reverser housing if so equipped) as instructed in Section 40, Group 10.

Install rockshaft housing as instructed in Section 50, Group 55.

Install final drives as instructed in Section 40, Group 30.

Position and secure ROPS and fenders to rear axle housing. Connect wire harness to fender lights.

Group 30
FINAL DRIVES

GENERAL INFORMATION

Each rear axle assembly is mounted on two tapered roller bearings with oil seals and a planetary gear system which provides the final 5-to-1 speed reduction.

REMOVAL

Disconnect battery ground strap. Disconnect rear wiring harness and free harness from fenders and axles housings.

Block up transmission or support with splitting stand to prevent tractor from tipping. Remove ROPS, rear wheels and fenders.

Disconnect hydraulic brake lines from axle assembly.

Attach a chain hoist to final drive housing and remove attaching cap screws.

Pull final drive housing from transmission case.

REPAIR

Refer to Fig. 1 for location of parts during disassembly and assembly.

Remove lock plate, special hex. bolt, and washer. Be sure to remove lock plate (22) before attempting to remove bolt.

Remove planet pinion carrier assembly from the splined end of the rear axle shaft.

Use snap ring pliers to expand large snap ring (26) on planet pinion carrier. Each planet pinion shaft (17) can be removed as snap ring is expanded to clear groove in planet carrier. Remove planet pinions and thrust washers. Be careful not to lose any of the bearing rollers which are used in each planet pinion.

Press rear axle out of final drive housing. Be sure housing is supported outside of oil seal (2, Fig. 1) to avoid damaging oil seal.

Examine final drive housing for cracks or breaks and replace if defective. Inspect the final drive gear in housing for damage or excessive wear. If the gear is worn or damaged beyond repair, the gear and the final drive housing must be replaced.

Install new inner oil seal (13) with sealing lips facing driver.

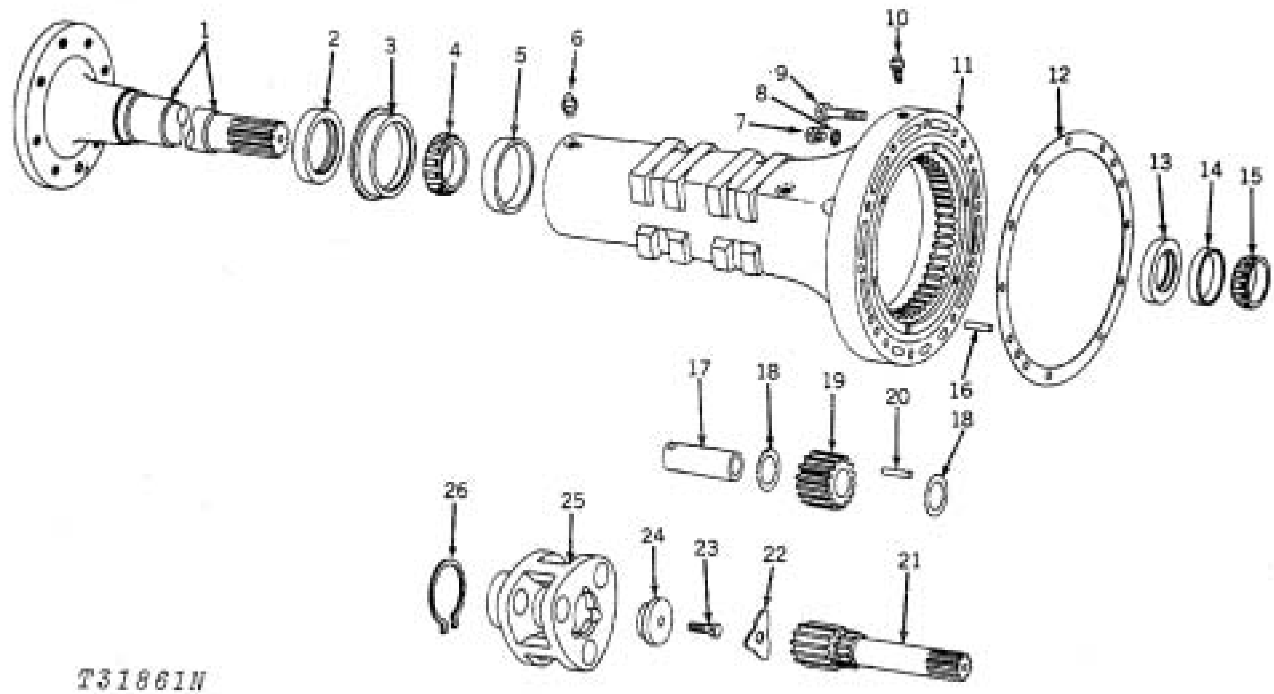
Check inner (14) and outer (5) bearing cups in housing for scoring, pitting, or excessive wear. Replace any parts found defective. Press new bearing cups into housing tight against shoulder with a 10,000 lb. (44 500 N) (4 536 kg) minimum load. Be sure to install outer oil seal cup.

Inspect planet pinion carrier (25) for cracks or breakage. Replace carrier if necessary. Check planet pinions and pinion shafts for damage or excessive wear and replace if necessary. Check bearing rollers for scoring, pitting, or excessive wear and replace entire set if any are found defective. Inspect snap ring and thrust washers for damage or undue distortion, and replace if necessary.

Check final drive shaft (21) and sun pinion for damage or wear. Replace if necessary.

Check oil seal (2) for damage or evidence of excessive leakage, and replace if necessary. Install new oil seal (2) with the metal side facing the axle flange and press tight against shoulder.

Inspect bearing cone for damage or excessive wear. If found defective, drive it from shaft. Heat new cone not to exceed 300°F (148.9°C), and drive into place on shaft while hot.



1—Axle Shaft (flanged)
2—Outer Oil Seal
3—Oil Seal Cup
4—Outer Bearing Cone
5—Outer Bearing Cup
6—Grease Fitting
7—Brake Oil Lead Plug
8—O-Ring
9—Cap Screw (11 used)
10—Brake Bleed Screw
11—Axle Housing with Gear
12—Gasket
13—Inner Oil Seal
14—Inner Bearing Cup
15—Inner Bearing Cone
16—Dowel Pin (3 used)
17—Planet Pinion Shaft (3 used)
18—Thrust Washer (6 used)
19—Planet Pinion (3 used)
20—Roller Bearing (69 used)
21—Final Drive Shaft
22—Lock Plate
23—Cap Screw
24—Washer
25—Planet Pinion Carrier
26—Snap Ring

Fig. 1-Rear Axle Assembly

Coat bores of planet pinions with SAE multipurpose-type grease, and position roller bearing (20, Fig. 1). Mount planet pinions and thrust washers in planet pinion carrier. Insert planet pinion shaft in far enough to secure bearing rollers. Install snap ring in shaft slots, and complete insertion of shafts. Be sure that snap ring is properly seated in groove in planet pinion carrier.

Coat lips of inner oil seal (13) and fill lips of outer oil seal (2) with a multi-purpose grease and install axle into housing.

IMPORTANT: Tape splined end of axle shaft with thin plastic tape to prevent damage to inner oil seal.

Heat inner bearing cone to a temperature not to exceed 300°F (148.9°C), and install cone on shaft.

Place planet pinion carrier assembly on shaft and pull bearing cone into position by tightening the special hex. bolt.

Tighten the planet pinion carrier retaining cap screw (23, Fig. 1) to 55 lb-ft (75 Nm) (8 kg-m).

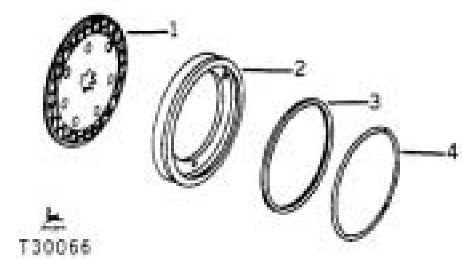
Rotate carrier a minimum of three times and re-torque cap screw (23) to 55 lb-ft (75 Nm) (8 kg-m).

Check axle rolling torque to be sure it is between 8 and 15 lb-ft (11 and 20 Nm) (1 and 2 kg-m).

Install lock plate.

Fill rear axle outer bearing compartment and bearing with SAE multipurpose-type grease.

BRAKE PRESSURE PLATE AND FACING



1—Brake Disk with Facings
2—Brake Pressure Plate
3—Packing (Outside)
4—Packing (Inside)

Fig. 2-Brake Assembly

Lift brake pressure plate from dowels on rear axle housing.

Check for signs of interference between brake pressure plate and axle housing.

Remove and discard packings from pressure plate. Check pressure plate for free movement in axle housing. If binding is noticed, pressure plate may not be returning properly causing excessive wear of the brake disk. Coat new packings with grease and install in grooves.

NOTE: If brake pressure plate (2, Fig. 2) cannot be easily removed, remove bleed screw on top of housing and attach a small hydraulic hand pump. Pump oil behind pressure plate to force it from the cylinder.

INSTALLATION

Replace sun pinion in differential assembly.

Position new gasket on face of final drive housing.

Install brake disk with facings so thickest facing is against transmission case.

Coat pressure plate with grease and install into annular cylinder in axle shaft housing. Be sure packings are not cut or turned over. Make sure dowels in final drive housing are in line with holes in pressure plate.

Install assembled final drive unit on tractor and tighten cap screws to 85 lb-ft (115 Nm) (12 kg-m).

Install ROPS and fenders.

Install wheels and connect wire harness to lights.

Group 35
SPECIFICATIONS AND SPECIAL TOOLS

CLUTCH ASSEMBLIES

SPECIFICATIONS AND TORQUE VALUES

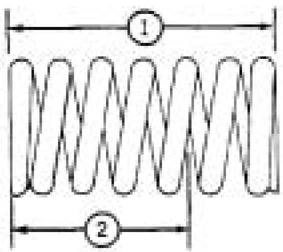


Fig. 1-Single Stage Clutch Spring

Clutch spring for single stage clutch (Continuous PTO or No PTO) (With Reverser)
1. Free length .... 2.445-in. (61.976 mm)
2. Test length
   at 234-lbs. (106.140 kg) 1.687-in. (42.926 mm)

Clutch spring for single stage clutch (Independent PTO) (Without Reverser)
1. Free length.............2.396-in. (60.706 mm)
2. Test length
   at 170-lbs. (77.110 kg)..1.570-in. (39.878 mm)

Clutch spring for single stage clutch (No PTO) (Without Reverser)
1. Free length .... 2.281-in. (57.912 mm)
2. Test length at
   156-lbs. (70.761 kg) ... 1.500-in. (38.100 mm)

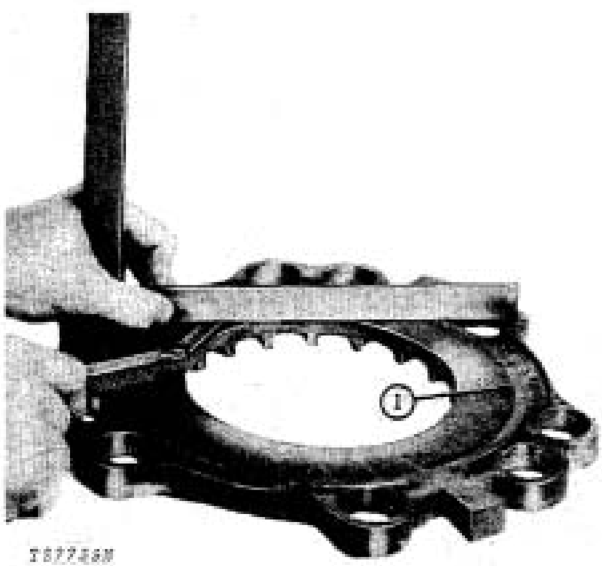


Fig. 2-Clutch Plate Drive Surface

1. Clutch plate driving surface flat
   within ....0.006 in. (0.15 mm)

CLUTCH ASSEMBLIES

SPECIFICATIONS AND TORQUE VALUES—Continued

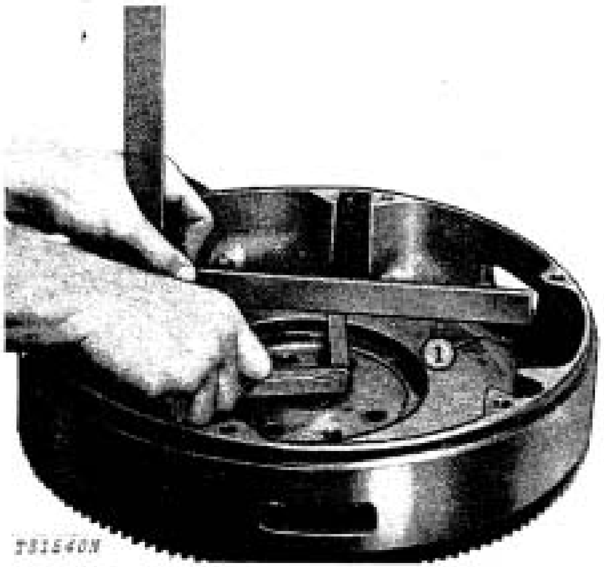


Fig. 3-Checking Flywheel Surface

1. Flywheel driving surface flat within .... 0.006 in. [0.15 mm]

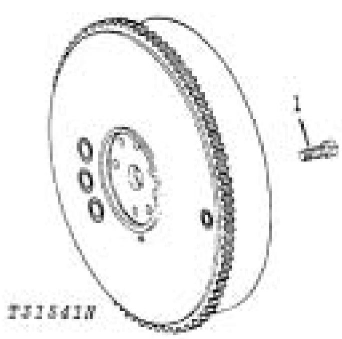


Fig. 4-Flywheel Retaining Cap Screws

1. Flywheel-to-engine crankshaft flange (F-Grade) .... 120 lb-ft (17 kg-m)

   (D-Grade) .... 85 lb-ft (12 kg-m)

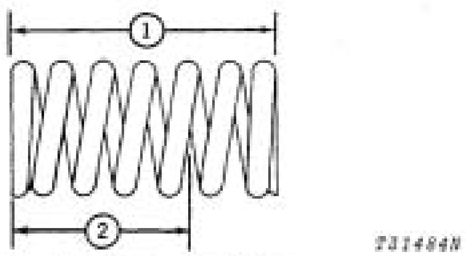


Fig. 5-Dual Stage Clutch Springs

Clutch spring for dual stage clutch (Inner Spring)
1. Free length .... 3.53 in. [89.7 mm]
2. Test length .... 1.75 in. [44.5 mm] at 56 lbs. [25.4 Kg-m]

Clutch spring for dual stage clutch (Outer Spring)
1. Free length .... 3.06 in. [77.7 mm]
2. Test length .... 1.85 in. [47.0 mm] at 123 lbs. [55.8 Kg]

CLUTCH ASSEMBLIES

SPECIFICATIONS AND TORQUE VALUES—Continued

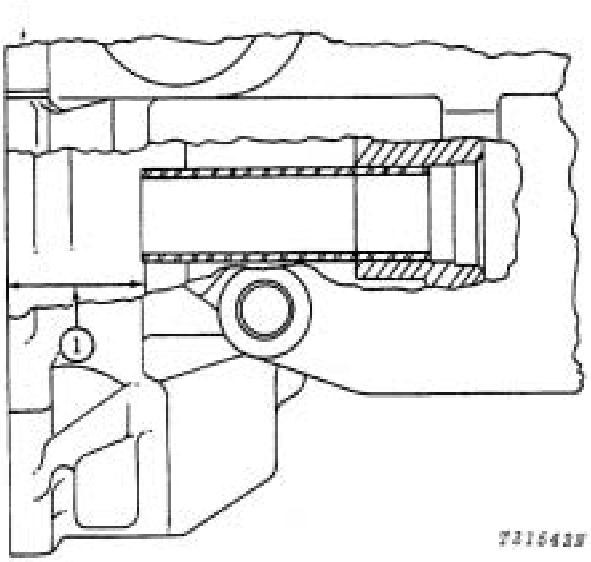
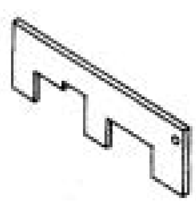


Fig. 6-Carrier Sleeve

1. Dimension from end of sleeve to the engine mounting surface of the clutch housing .... 2-13/16 in. (71.4 mm)

SPECIAL TOOLS

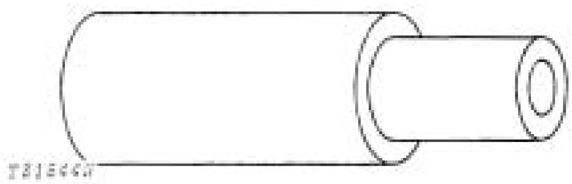
Essential Tools

Tool	Tool No.	Use
 *Fig. 7-Clutch Adjusting Gauge*	JD-7	Adjusting engine clutch pressure plate finger height (units with reverser).
	JD-227	Adjusting engine clutch finger (units without reverser).

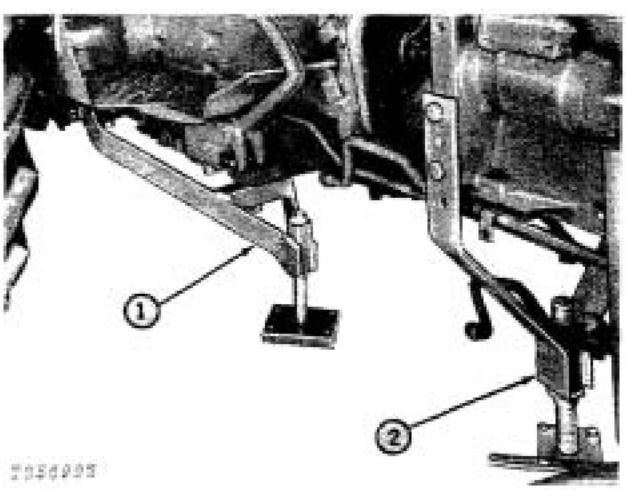
CLUTCH ASSEMBLIES

SPECIAL TOOLS—Continued

Essential Tools—Cont.

Tool	Tool Number	Use
 Fig. 8-Dual Stage Adapter	JDE-52-1	To properly line up dual stage clutch disk.

Convenience Tools

Tool	Tool Number	Use
 Fig. 9-Support Stands	1. JDG-2A 2. JDG-2K	Support rear half of tractor. Support front half of tractor.

TRANSMISSION

SPECIFICATIONS AND TORQUE VALUES

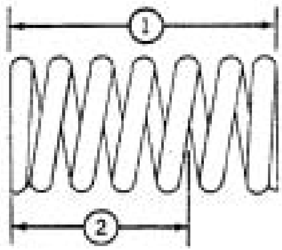


Fig. 10-Transmission Friction Plug Spring

Transmission friction plug spring
1. Free length .... 1.87 in. [47.5 mm]
2. Test length............................ 1.51 in. [38.4 mm] at 70 lbs. [31.8 kg]

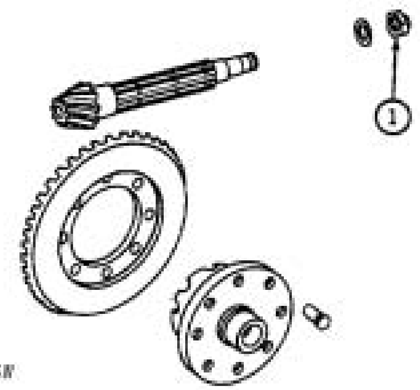


Fig. 11-Differential Drive Shaft Nut

1. Ring gear and pinion shaft nut............ 160 lb-ft. [22.121 kg-m] and stake in place.

SPECIAL TOOLS

Convenience Tools

TOOL

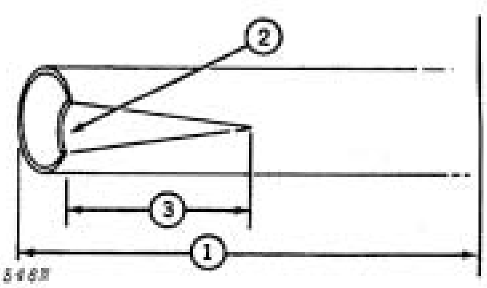


Fig. 12-Tool for Transmission Shifter Interlock Balls

The procedure to make tool is as follows:

1. Cut a 6 to 7 in. [152.400 to 177.800 mm] length of 1/2 in. [12.700 mm] electrical conduit.
2. Make an indentation 1/4-in. [6.350 mm] deep on one end.
3. Taper the indentation out 1-in. [25.400 mm] along tube.

REVERSER

SPECIFICATIONS AND TORQUE VALUES

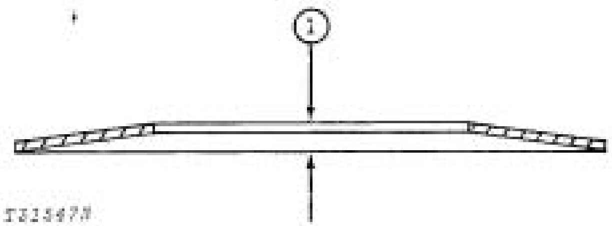


Fig. 13-Spring Washer

1. Approximate free height of spring washer
   Reverse brake release ....0.143-in. [3.556 mm]
   Forward clutch release ....0.183-in. [4.572 mm]

DIFFERENTIAL AND PARKING BRAKE

SPECIFICATIONS AND TORQUE VALUES

Fig. 14-Differential Housing

1. Differential housing cover-to-ring gear
   housing ....35 lb-ft. [4.8 kg-m]

DIFFERENTIAL AND PARKING BRAKE

SPECIFICATIONS AND TORQUE VALUES - Continued

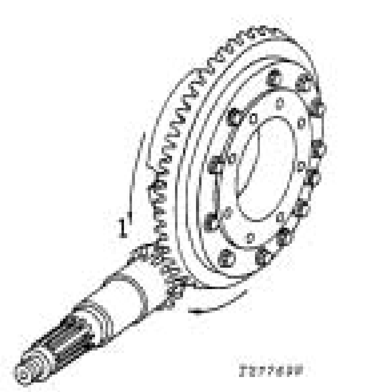


Fig. 15-Pinion Shaft and Ring Gear

1. Backlash between ring gear and pinion shaft.......... 0.006 to 0.008 in. [0.15 to 0.20 mm]

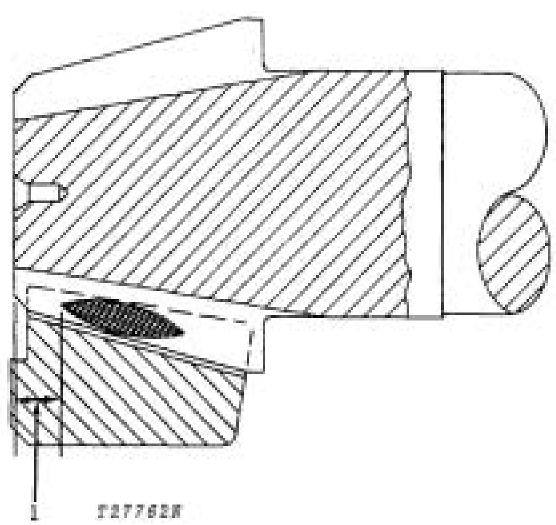


Fig. 16-Tooth Pattern

1. Tooth pattern location from end of pinion teeth...... 0.120 to 0.360 in. [3.048 to 9.144 mm]

FINAL DRIVES

SPECIFICATIONS AND TORQUE VALUES

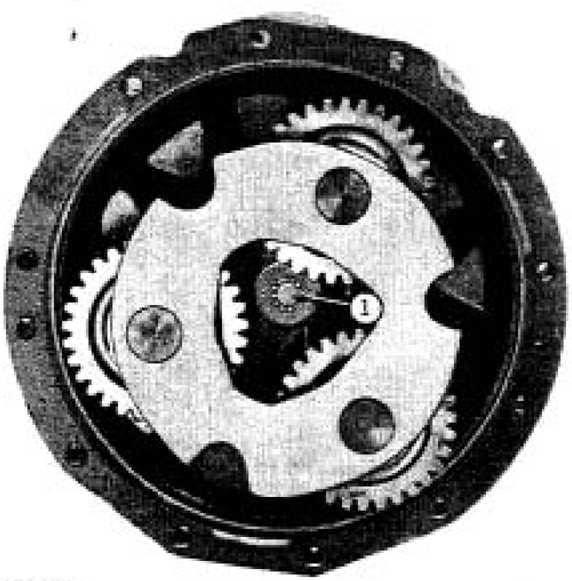


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Fig. 17-Planet Pinion Carrier

1. Planet pinion carrier-to-axle
   screw............ 55 lb-ft (75 Nm) (7.604 kg-m)

Tighten cap screw, rotate carrier a minimum of three times and retighten to specifications. Rolling torque to be from 8 to 15 lb-ft (11 to 20 Nm) (1 to 2 kg-m).

Section 50
HYDRAULIC SYSTEM

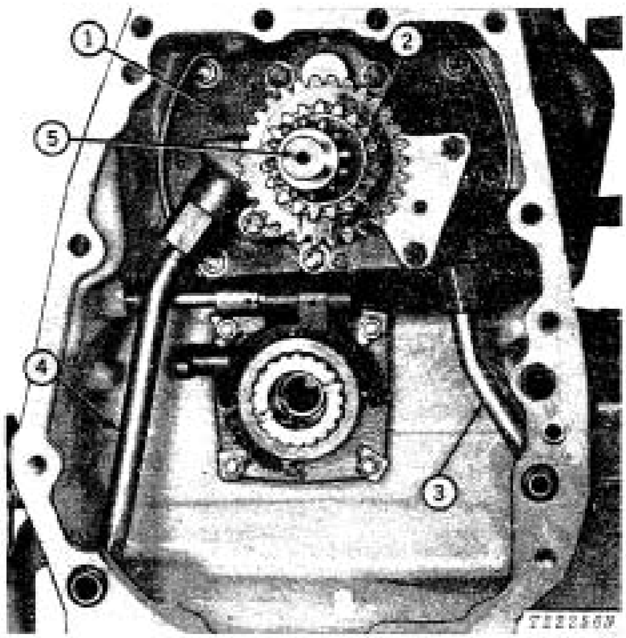
CONTENTS OF THIS SECTION

CAUTION: Escaping fluid under pressure can have sufficient force to penetrate the skin, causing serious personal injury. Before disconnecting lines, be sure to relieve all pressure. Before applying pressure to the system, be sure all connections are tight and that all lines and hoses are not damaged. Fluid escaping from a very small hole can be almost invisible. Use a piece of cardboard or wood, rather than hands to search for suspected leaks.

If injured by escaping fluid, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered immediately.

Group 5
TRANSMISSION PUMP

GENERAL INFORMATION



1—Transmission Oil Pump
2—Powershaft
3—Outlet Line
4—Inlet Line
5—Clutch Shaft

Fig. 1-Transmission Oil Pump Attaching Points

The transmission oil pump (Fig. 1) is a contant displacement, gear-type pump, located on the rear wall of the clutch housing and driven at engine speed by the powershaft (clutch shaft on transmission-driven PTO systems).

FOS For additional gear-type pump information, refer to "Hydraulic Pumps" in FOS Manual - HYDRAULICS.

REMOVAL

Separate transmission from clutch housing (Section 40, Group 5).

Remove pump inlet and outlet tubes.

Pull clutch shaft and powershaft from pump drive gear (clutch shaft only on transmission-driven PTO system).

Remove pump from rear of clutch housing.

REPAIR

Refer to Fig. 2 during disassembly and assembly of the pump.

Separate pump body (8) from pump adapter (11) and remove pump gears (10).

Check pump body for damage. Burrs can be removed with a file. Replace housing if cracked or badly scored.

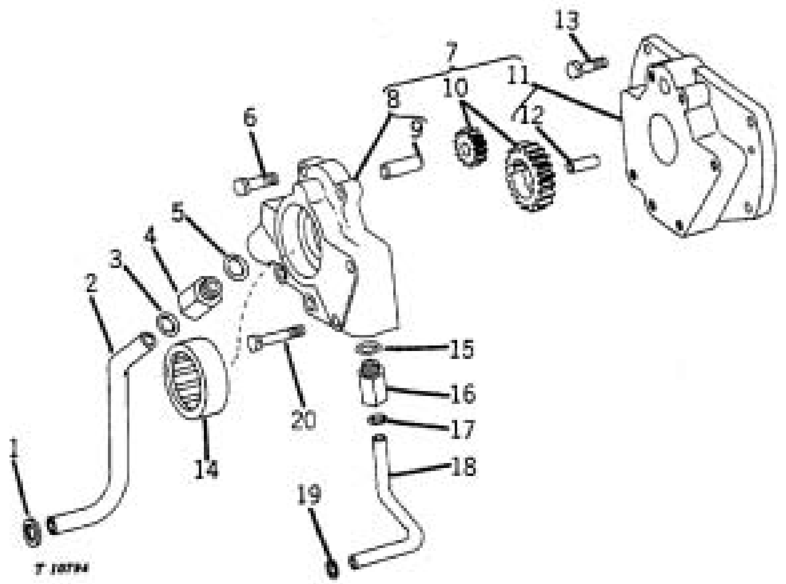
Examine roller bearing (14) in pump drive shaft bore for wear or damage. Install new bearing to bottom of bearing bore.

Inspect pump adapter for damage or wear.

Inspect pump gears for damage. Examine idler gear bushing for wear. Replace gears if unfit for service. Both gears must be replaced as a matched set.

Assemble pump body with gears and bearing to pump adapter.

IMPORTANT: Thoroughly coat all sides and faces of the pump gears with same type of oil used in the transmission before installation. Failure to do so could lead to scoring or seizure of the pump gears.



1—Packing
2—Inlet Line
3—O-Ring
4—Adapter
5—O-Ring
6—Cap Screw
7—Pump Assembly
8—Pump Body
9—Pin
10—Gear Assembly
11—Adapter
12—Pin (3 used)
13—Cap Screw (4 used)
14—Roller Bearing
15—O-Ring
16—Adapter
17—Packing
18—Outlet Line
19—Packing
20—Cap Screw (5 used)

Fig. 2-Transmission Oil Pump (without Reverser)

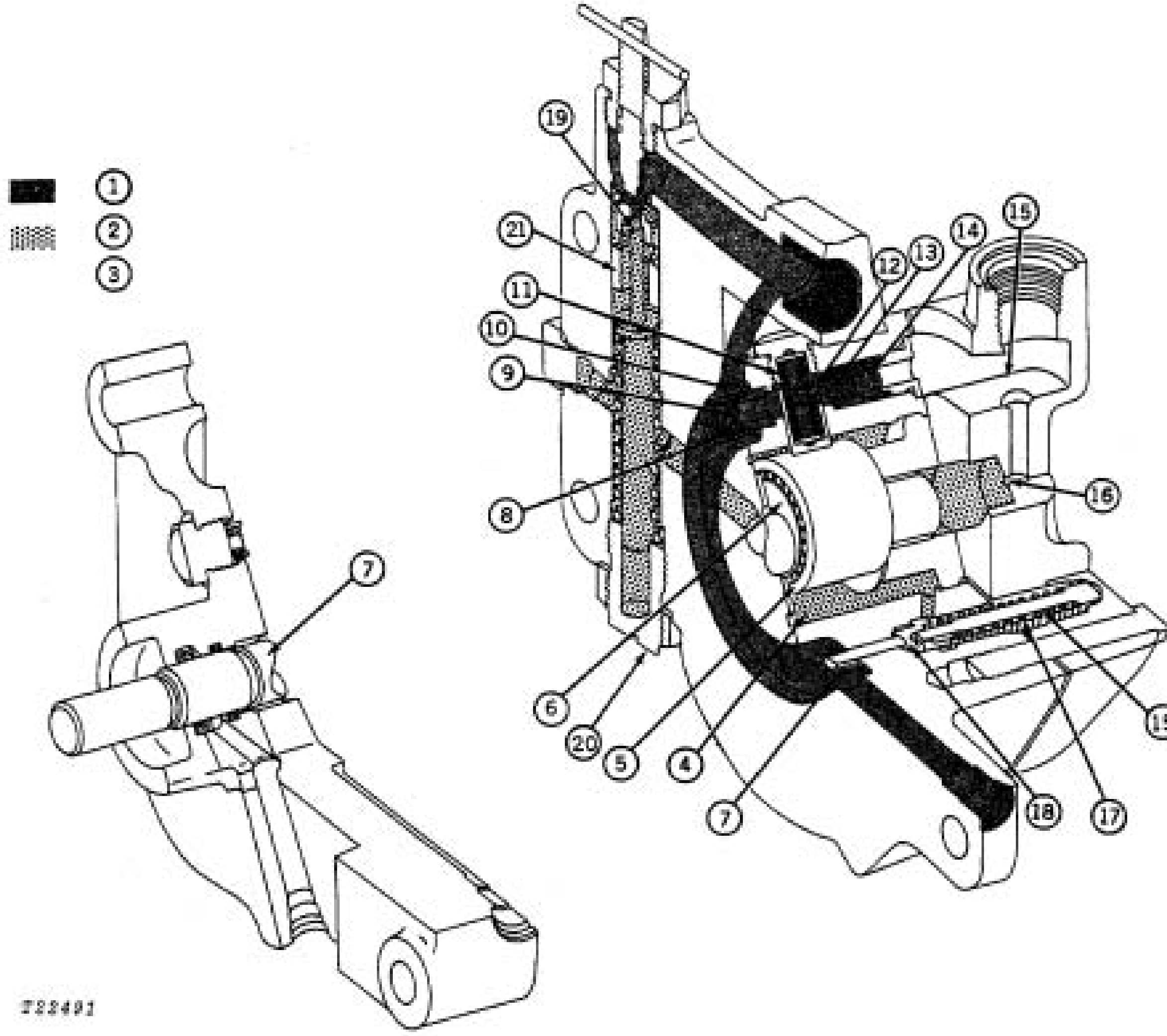
INSTALLATION

Install pump on rear wall of clutch housing.

Join clutch housing and transmission (Section 40, Group 5).

Group 10
MAIN HYDRAULIC PUMP

GENERAL INFORMATION



1—High Pressure Oil
2—Low Pressure Crankcase Oil
3—Low Pressure Oil from Transmission Oil Pump
4—Pump Crankcase
5—Race
6—Cam
7—Pump Shaft
8—Outlet Valve Spring
9—Outlet Valve
10—Pressure Outlet Gallery
11—Piston Spring
12—Piston
13—Inlet Valve Spring
14—Inlet Valve
15—Inlet Gallery
16—Bleed Passage
17—Crankcase Outlet Valve Spring
18—Crankcase Outlet Valve
19—Stroke Control Valve Guide
20—Stroke Control Valve Adjusting Screw
21—Stroke Control Valve

Fig. 1-Main Hydraulic Pump

The main hydraulic pump is a variable displacement, constant pressure, radial piston type.

FOS

See "Radial Piston Pumps" in FOS Manual—"HYDRAULICS" for additional description and theory of operation.

REMOVAL

Disconnect and cap pump lines and remove pump from the unit.

REPAIR

Before disassembly of pump is started, thoroughly clean exterior of pump. Check pump shaft end play. End play should be from 0.0040 to 0.0380 in. [0.10 to 0.96 mm]. Excessive end play may be an indication of worn thrust washers.

Using Fig. 2 as an aid in identifying pump parts disassemble pump as follows.

Remove pump cover from housing.

Remove the crankcase outlet valve spring and guide which are loose in housing. Using a magnetic pick-up tool, remove crankcase outlet valve and pin from valve bore in housing. Remove outer thrust washer.

Holding the roller bearing race in place, pull the shaft from the pump housing.

Remove piston springs, spring seats, and pistons. Remove bearing race and other thrust washer.

Return all pistons, springs, valves, and seats to the bore from which they were removed. A JDH-21 pump parts tray will be helpful in keeping the individual parts separate.

Remove inlet valve seats, balls, springs and guides.

Remove discharge valve plugs, and slide discharge valve stops, guides, springs, and valves from bores. Use JDE54 driver to remove discharge valve seats from their bores.

Remove plug and slip stroke control valve screen filter from pump.

Remove stroke control valve adjusting screw, and slide spring, valve spring, valve guide, and valve from bore.

Check dimension of finished face of pump housing-to-bottom of cam and race bore. Wear at this point will give excessive pump shaft end play.

Check pump shaft bearing in housing for wear or scoring. Remove old bearing, using care not to mar machined surfaces in pump. Install new bearing to 0.0200 in. [0.51 mm] below finished surface of pump housing.

Examine pump shaft bore around quad ring seal groove. Wear at this point could cause crankcase oil leakage and cause the pump to be slow going out of stroke.

Check condition of outlet valve seats (14, Fig. 2) pressed into outlet valve bores. If seats are damaged, remove and drive in new seats with large chamfered end toward bottom of bore. Press seats in to 1.7100 in. [43.434 mm] below spot face surface of bore. *Press on shoulder of seats only.*

Check pistons (46) for scoring or pitted faces.

Always replace O-ring (9) when plug (20) is removed from housing.

All piston springs (48) should be matched to each other within 0.15 pounds [0.068 kg].

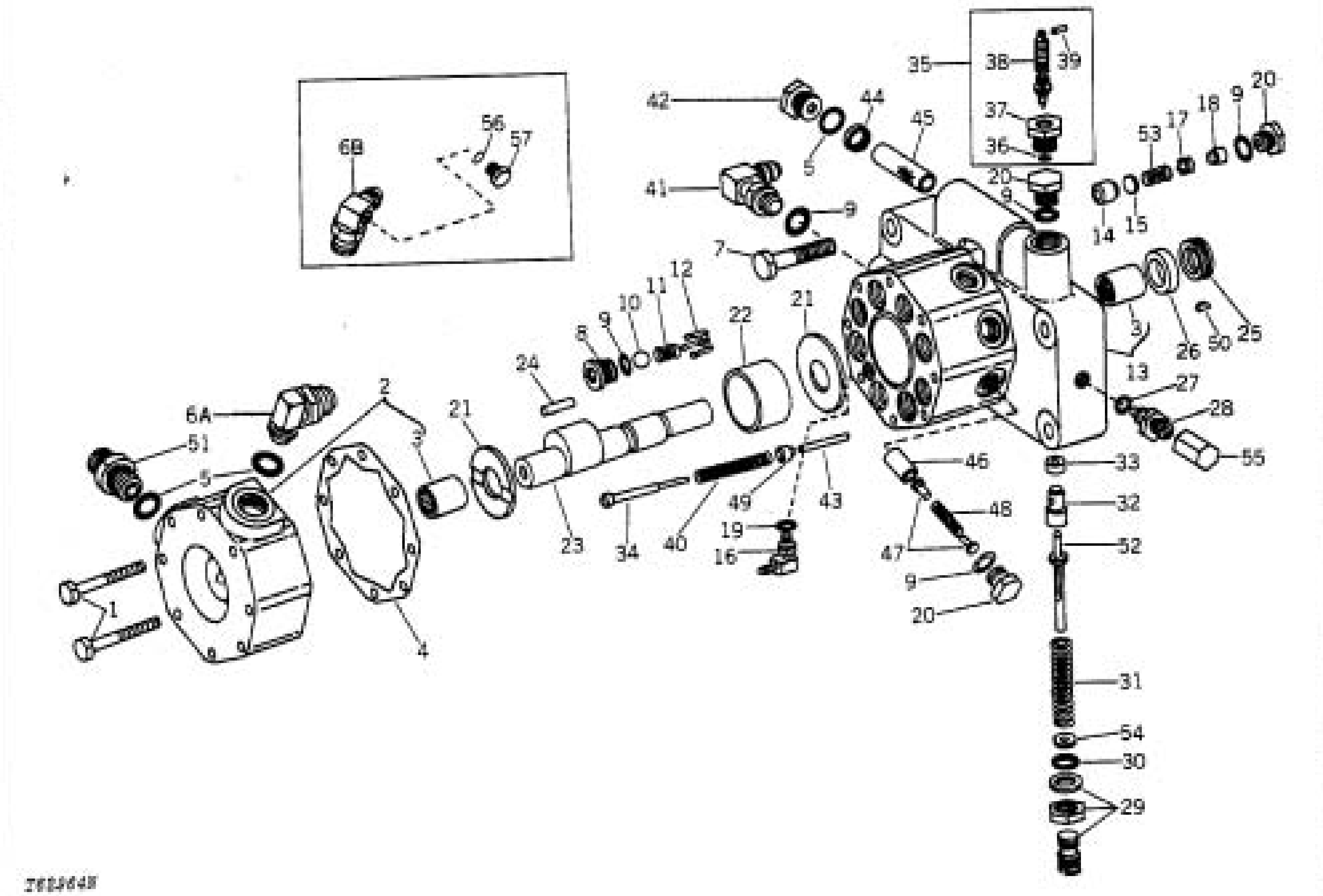
Inspect inlet valve assemblies for damaged springs (11), guide (12), balls (10), and seats (8).

Always replace O-ring on inlet valve seat whenever inlet valve assemblies are removed.

Examine outlet valve (15) for wear or damage. Check spring guide (17), spring (53), and outlet valve stop (18) for damage.

Check inlet and outlet valve springs. Inlet valve spring has 0.510 in. [12.9 mm] free length and 0.300 in. [7.6 mm] test length with 0.310 to 0.390 pounds [0.14 to 0.18 kg]. Outlet valve spring has 0.480 in. [12.2 mm] free length and 0.300 in. [7.6 mm] test length with 2.540 to 3.140 pounds [1.15 to 1.42 kg].

Replace O-ring on outlet valve plug whenever valve assembly is removed.



1 —Cap Screw (8 used)
2 —Hydraulic Pump Cover
3 —Needle Bearing (2 used)
4 —Gasket
5 —O-Ring Packing (3 used)
6A—Elbow (-290934)
6B—Tee (290935-)
7 —Cap Screw (4 used)
8 —Inlet Valve Seat (4 used)
9 —O-Ring Packing (26 used)
10 —Inlet Valve Ball (8 used)
11 —Inlet Valve Spring (8 used)
12 —Inlet Valve Guide (8 used)
13 —Hydraulic Pump Housing
14 —Outlet Valve Seat (8 used)
15 —Outlet Valve (8 used)
16 —Elbow
17 —Outlet Valve Guide (8 used)
18 —Outlet Valve Stop (8 used)
19—O-Ring
20—Plug (17 used)
21—Special Thrust Washer (2 used)
22—Race
23—Hydraulic Pump Shaft
24—Roller Bearing (33 used)
25—Seal
26—Packing
27—O-Ring Packing
28—Connector
29—Stroke Control Valve Adjusting Screw
30—O-Ring Packing
31—Stroke Control Valve Spring
32—Stroke Control Valve
33—Stroke Control Valve Seat
34—Crankcase Outlet Valve Spring Guide
35—Hydraulic Pump Shut-Off
36—O-Ring Packing
37—Bushing
38—Shut-Off Screw
39—Spring Pin
40—Crankcase Outlet Valve Spring
41—Elbow
42—Plug
43—Crankcase Outlet Valve Piston Pin
44—Packing (2 used)
45—Stroke Control Valve Filter
46—Piston (8 used)
47—Piston Spring Guide (16 used)
48—Piston Spring (8 used)
49—Crankcase Outlet Valve
50—Woodruff Key
51—Connector
52—Stroke Control Valve Guide
53—Outlet Valve Spring (8 used)
54—Washer
55—Cap
56—O-Ring
57—Plug

Fig. 2-Main Hydraulic Pump

Inspect stroke control valve (32) for damage or rough spots which might prevent valve from sealing properly.

Check stroke control valve spring (31) for broken or compressed coils. Spring should test to free length of 2.870 in. [72.9 mm] and test length of 2.5 in. [63.5 mm] with 158 to 192 pounds [71.7 to 87.1 kg].

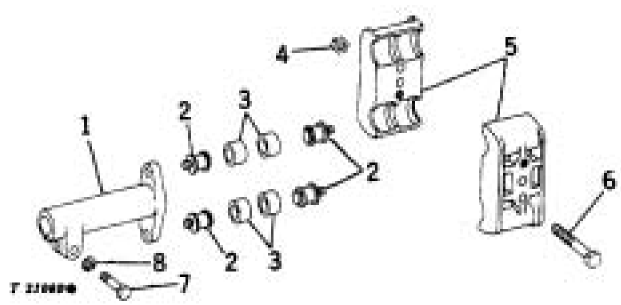
Examine stroke control valve seat (33) for damage or wear. If replacement is necessary, remove pump shut-off screw assembly or plug and drive seat from bore. Drive inner seat with chamfered end first until it bottoms in valve bore.

Thoroughly clean stroke control valve filter (45). Always replace packing on each end of filter whenever pump is disassembled for repair.

Check bearing race (22) for worn spots in area where it contacts pump pistons. Replace race if excessively worn.

Check thrust washer (21) for wear and scoring. A worn thrust washer will give pump drive shaft excessive end play.

Check pump shaft bushing or needle bearing (3) in cover for wear or damage. Install needle bearing to 0.0200 in. [0.51 mm] below finished surface of pump cover.



1—Drive Shaft	**5—Coupler Halves (2 used)**
2—Screw (4 used)	**6—Cap Screw (2 used)**
3—Hose (4 used)	**7—Cap Screw**
4—Stop Nut (2 used)	**8—Lock Washer**

Fig. 3-Pump Drive Assembly

Check pump drive assembly using Fig. 3 as a guide.

Dip all O-rings, valves, guides, and roller bearings in hydraulic oil.

Install packing (26) in groove around pump drive shaft bore in pump housing.

Coat sealing lips of oil seal (25) with oil and install in pump housing with printed side to the outside. Use a driver that contacts outer metal rim of seal and drive to bottom of chamfer in oil seal bore.

Place a thrust washer in pump housing with oil groove facing housing. Install bearing race over washer.

Insert needle bearings around inner circumference of race. Grease bearings to hold them in place. Install pump shaft (driving end first) into pump housing.

Be sure there are 33 needle bearings installed in pump.

Install pump pistons, spring seats, springs, piston plugs in holes located radially around pump body. Tighten piston plugs to 100 lb-ft. [13.8 kg-m].

Install inlet valve guides, springs, and balls to seats and place inlet valve bores. Use new O-ring packings over seats and tighten securely.

Slip crankcase outlet valve pin into outlet valve bore in housing. Place crankcase outlet valve (closed end first), spring, and spring guide in outlet valve bore. Install other thrust washer (grooves facing out).

Place new pump cover gasket on pump body and install pump cover. Be sure crankcase outlet valve assembly fits into mating hole in inlet gallery of cover. Dip cover-to-pump body cap screws in oil before assembly and tighten to 36 lb-ft. [5.0 kg-m].

Use Discharge Valve Seat Installation Tool and install outlet valve seats in their bores.

With outlet valve seats installed in pump body, install outlet valves, springs, guides, and stops in outlet valve bores. Tighten outlet valve plugs securely.

Install stroke control valve filter screen in bore. Be sure packings are in place on ends of screen. Install plug.

Place stroke control valve (smaller diameter first) in valve bore. Install valve guide (small end first) in valve. Place spring over pin and install stroke control valve adjusting screw.

Add oil to seal cavity through bleed line connector to provide initial lubrication for shaft seal.

INSTALLATION

Using a few drops of Loctite on each screw, install special screws to crankshaft pulley and tighten to 35 lb-ft. [4.8 kg-m]. Slip rubber hose segments on screws.

Place two special screws in pump drive shaft using Loctite on each screw and tighten to 35 lb-ft. [4.8 kg-m]. Place rubber hose segments over screws.

Clamp pump drive shaft to crankshaft pulley using coupler halves, cap screws, and self-locking nuts. Leave cap screws loose until pump is installed. Couplers should be loose on pump drive screws.

Using a Woodruff key in slot of pump shaft, position pump against mounting surface of tractor front support, indexing shaft in pump drive assembly.

Fasten pump to tractor front support and tighten attaching hardware.

With pump tightened to mounting flange, position pump drive assembly so that couplers contact rubber bushings only, not the drive screws.

Tighten coupler screws to 25 lb-ft. [3.4 kg-m]. Then retighten screws again starting with first screw tightened. Tighten coupler screw lock nuts to 25 lb-ft. [3.4 kg-m].

Connect pump lines.

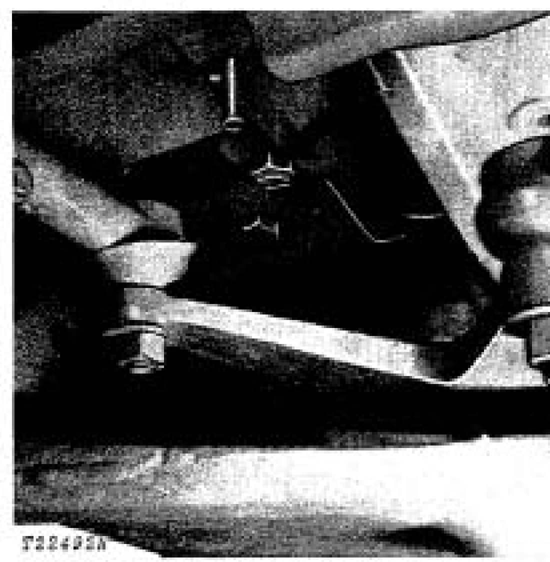


Fig. 4-Hydraulic Pump Stroke Control Adjusting Screw

Install a hydraulic test unit or pressure gauge and start engine to pressurize the system.

Turn the stroke control valve adjusting screw (Fig. 4) out until the spring pressure on the screw is relieved.

Then turn the adjusting screw in until 2200 to 2300 psi [154.7 to 161.7 kg/cm^2] is recorded on the gauge. Tighten the jam nut.

Group 15
REVERSER CLUTCH CONTROL VALVE

GENERAL INFORMATION

The reverser is a hydraulic and mechanical device which changes the direction of tractor travel under full load without shifting the transmission gears. A single compound planetary set of gears, a reverse brake, and one clutch are utilized to accomplish this type of directional shifting.

A "high-speed" lockout is provided in the reverser and transmission control mechanisms to allow reverse shifting only when the transmission is in low range.

NOTE: Units starting with S.N. (277182) will not have the high range reverse lockout.

Thus, four reverse speeds are provided, each approximately 16% faster than their respective forward low range speeds.

Oil Supply

Oil for reverser operation, lubrication, and cooling is drawn from the transmission case (main transmission-hydraulic oil reservoir) by the transmission oil pump located at the rear of the reverser. The oil is pumped through an oil filter before entering the reverser clutch control valve. An oil cooler, located at the front of the tractor and attached to the radiator, cools the transmission-hydraulic oil.

Control Valve Assembly

The reverser control valve housing, located on the right side of the tractor between the clutch housing and brake valve, receives pressure oil from the transmission oil pump.

Clutch Control Valve

The clutch control valve is controlled by the clutch pedal. Engaging the clutch pedal moves the clutch control valve, opening the pressure oil passage to the shift valve. Disengaging the clutch pedal moves the valve to close off pressure oil flowing to the shift valve and allows oil from the engaged clutch pack to return to sump. The accumulator remains charged when the clutch pedal is depressed, as the clutch control valve blocks the accumulator discharge port.

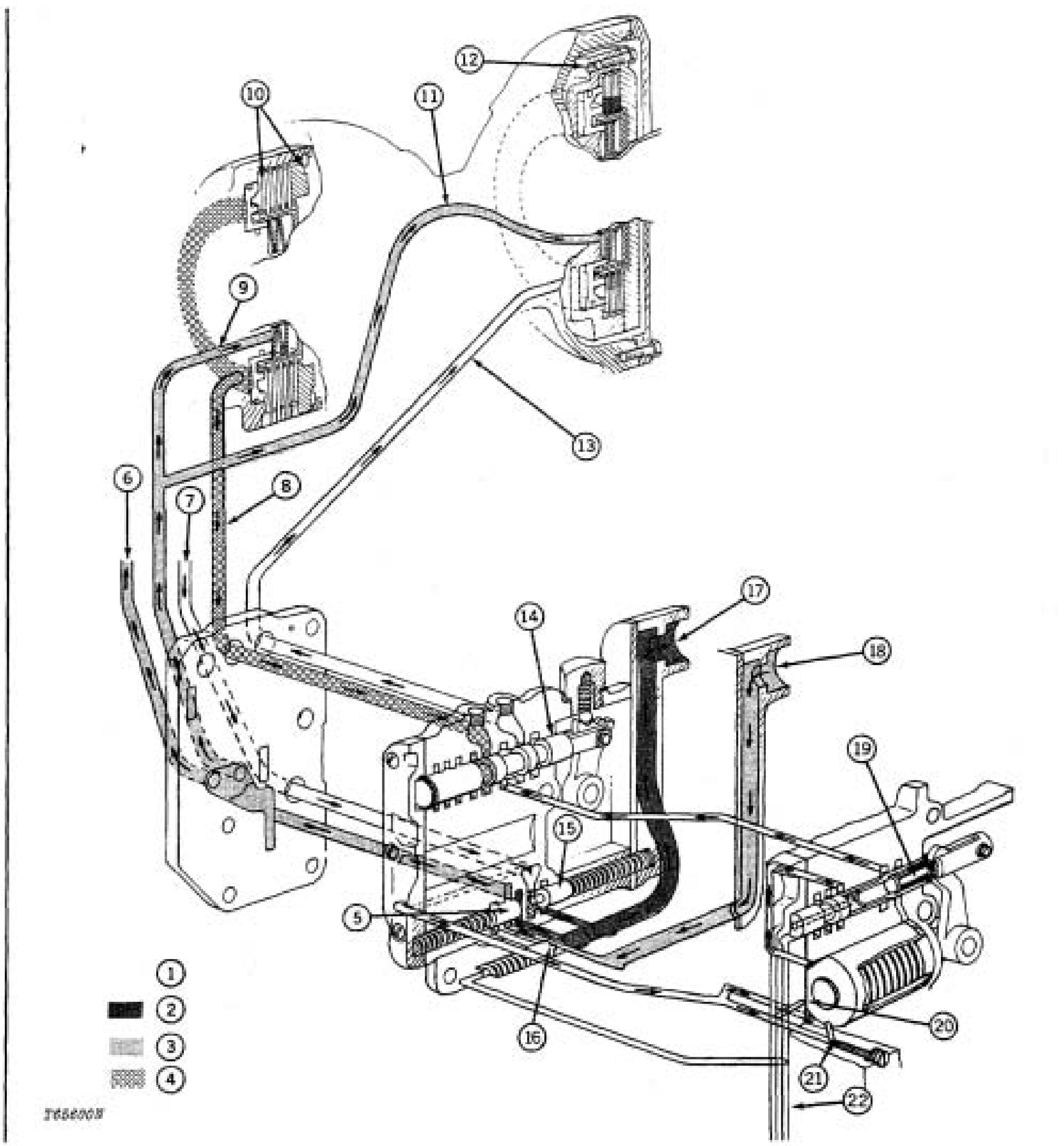
To obtain a close control of pressure oil (for inching into loads) a spring and movable stop are placed in the clutch control valve. This spring and stop allows the operator to closely regulate clutch pressure oil with the clutch pedal.

Shift Valve (Directional Valve)

The spool-type shift valve is operated by the reverser control lever and has two detented positions, forward and reverse, for direction control of the tractor. A neutral position is not provided. This valve directs oil to engage the selected clutch pack during a shift. It also allows oil to return from the other clutch.

Accumulator Charging Orifices

A fixed accumulator charging orifice is provided to give a minimum accumulator charging rate. An adjustable charging orifice is also provided to vary the accumulator charging rate, controlling shift time. Closing the orifice decreases the rate of pressure rise and provides a smoother or softer shift. Opening the orifice increases the rate of pressure rise and reduces the tendency to drop torque under load, but makes shifts sharper under no load.



1—Pressure Oil
2—Inlet Oil To Main Hydraulic Pump
3—Lube Oil From Cooler
4—Return Oil To Sump
5—Cooler Bypass and Relief Valve
6—Lube Oil To Transmission
7—Oil From Transmission Oil Pump
8—Oil Line To Reverser Brake
9—Reverser Brake Lube Oil Line
10—Reverser Brake Assembly
11—Forward Clutch Lube Oil Line
12—Forward Clutch Assembly (engaged)
13—Oil Line To Forward Clutch
14—Shift Valve
15—Pressure Regulating Valve
16—Lube Oil Reduction Valve
17—To Cooler
18—From Cooler
19—Clutch Control Valve
20—Fixed Charging Orifice
21—Adjustable Charging Orifice
22—Test Port

Fig. 1-Reverser Clutch Control Valve

Accumulator

The accumulator is a spring-loaded piston located in the center of the reverser control valve housing. It controls pressure build-up during a shift and provides the following distinct functions:

(A) Maintains oil in reserve to provide a "surge" of oil to assist in moving the forward clutch or reverse brake pistons rapidly toward engagement during a directional shift. (B) Provides a low system pressure at the time of initial clutch or brake engagement. This provides smoother shifting.
(C) Gives a gradual pressure build-up as the shift is accomplished and provides for a rapid pressure build-up to full engagement when the shift is completed.

Pressure Regulating Valve

A shim-adjusted regulating valve is provided to maintain full engagement pressure for reverse brake and forward clutch operation. In operation, this valve opens a passage to the cooler and allows oil not utilized by the reverser clutch packs to be sent via the main pump charging line to the oil cooler.

Cooler Bypass and Relief Valve

This valve protects the oil cooler from excessively high oil pressures, such as during cold weather when oil is stiff. The spring loaded valve bypasses cooler supply oil to the clutch lubrication circuit or, if pressures are excessively high, relieves oil to sump.

Lubrication Oil Pressure Reduction Valve

Pressure of oil returning from the cooler to the clutches depends upon line restriction, oil temperature, and engine rpm. This oil pressure could cause clutch drag and tractor creeping when the clutch pedal is depressed. The lubrication oil pressure reduction valve acts to reduce oil pressure when the clutch pedal is depressed (clutch control valve moved forward). Full engagement pressure behind this valve is dropped to zero when the clutch pedal is depressed, causing cooler return oil (lubrication oil) to move the valve against spring pressure and open the lubrication circuit to sump. This eliminates the possibility of reverser clutch drag.

Operation of Control Valve

Pressure oil from the transmission oil pump and oil filter is routed to the reverser control valve housing. The pressure regulating valve maintains pressure of oil going to the clutch control valve and clutch packs. Since the volume of oil required by the clutch packs and accumulator is small, the valve will be opened by the incoming oil and will divert excess oil to the oil cooler.

Oil in the lubrication circuit remains at a pressure dependent on line restriction and oil temperature, unless the clutch pedal is depressed. At this time lubrication pressure will drop.

For purposes of explanation, let us discuss the function of the reverser control valve assembly during a shift from reverse to forward drive. Before the shift, assume that the accumulator is fully charged and the reverse brake pack is also fully pressurized.

Shift Valve

As the reverser control lever is moved forward, the shift valve is moved forward and stopped in the rear detent position. The lands on the shift valve now uncover the groove in the valve housing leading to sump and connect sump with the reverse brake. The reverse brake now dumps oil. At the same time the shift valve lands open the pressure oil passage in the control valve housing to the forward clutch pack and clutch pressurization is started.

During the shift, accumulator pressure is dropped as the spring moves the accumulator piston rearward, and pressure oil is sent to the forward clutch. Approximately 1/10 of a second after the start of the shift the oil pressure starts to increase in the accumulator and clutch packs. Before full clutch engagement pressure in the clutch pack can be obtained, the accumulator must be charged to full pressure.

Initial accumulator charging is accomplished by means of two orifices, one fixed and the other adjustable. The fixed orifice provides for a minimum charging rate; the adjustable orifice is provided to increase the charging rate. Therefore, the tractor rate of shifting can be varied by this adjustable orifice.

When accumulator pressures reach 100 psi [7.0 kg/cm^2] (this should require 3/4 to 1-1/4 seconds), another charging orifice is uncovered by the accumulator piston. With the added pressure oil entry, the accumulator and clutch pack pressures rise instantly to full engagement pressure for the clutch pack.

Clutch Control Valve

Operating the clutch pedal to stop tractor motion moves the clutch control valve forward, closing off pressure oil from the clutch packs and opens the engaged clutch pack pressure line to sump, neutralizing this clutch. The accumulator remains charged as the accumulator discharge port is closed by the clutch control valve.

As the clutch pedal is released, the clutch control valve is moved, uncovering the pressure oil port and connecting it with the proper clutch pack. A spring within the valve provides a controlled clutch engagement.

REMOVAL

Clean area around brake valve and reverser clutch control valve before removing from unit.

Remove brake valve and reverser clutch control valve from unit.

REPAIR

Refer to Fig. 2 and 3 during disassembly and assembly of the reverser clutch control valve.

The control valve rear cover is spring loaded by the accumulator spring so loosen cover screws evenly. Identify valves and springs for assembly purposes.

Clean all valve housing passages and openings.

Press new seals in control shaft bores until outer edge of seal is flush with bottom of bore chamfer.

Check the following springs for free length and test length.

Clutch control valve spring (8, Fig. 2) free length of 1.63 in. [41.5 mm] and test length of 1.12 in. [28.5 mm] at 33 ± 3.3 pounds [15.0 ± 1.5 kg] force.

Lube pressure reduction valve spring (17, Fig. 2) free length of 2.06 in. [52.5 mm] and test length of 0.75 in. [19.0 mm] at 4.3 ± 0.4 pounds [1.95 ± 0.19 kg] force.

Cooler bypass and relief valve spring (18, Fig. 2) free length of 2.80 in. [71.0 mm] and test length of 2.05 in. [52.0 mm] at 20 ± 2 pounds [9.0 ± 0.9 kg] force.

Accumulator piston spring (19, Fig. 2) free length of 3.62 in. [92.0 mm] and test length of 2.62 in. [66.5 mm] at 313 ± 31 pounds [142.0 ± 14.2 kg] force.

Pressure regulating valve spring (22, Fig. 3) free length of 3.27 in. [83.0 mm] and test length of 2.56 in. [65.0 mm] at 29.4 ± 2.9 pounds [13.34 ± 1.32 kg] force.

Lubricate all parts before assembling.

Be sure valves and springs are installed in their proper bores.

NOTE: Cooler relief valve (30B, Fig. 2) must be installed with end with groove toward the valve body.

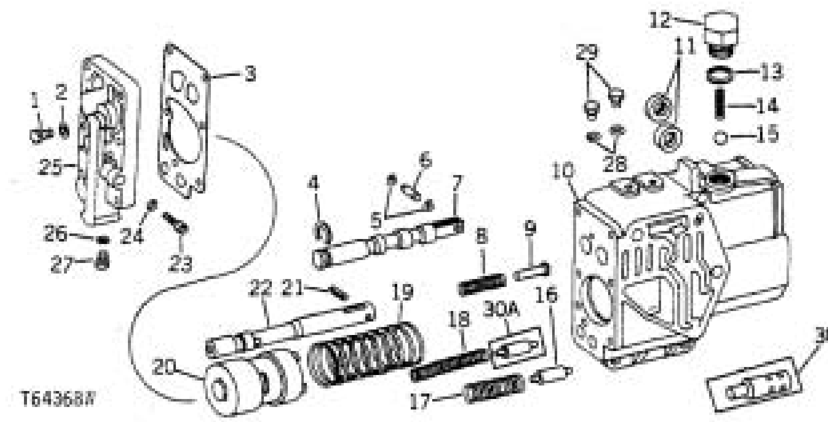
Bottom charging orifice screw (23, Fig. 2) and back out five complete turns for preliminary setting. Refer to Section 70 for testing and final adjustment.

Install cover on valve housing, compressing accumulator spring. Be sure piston is not cocked in bore.

Tighten cover to 10 lb-ft. [1.38 kg-m].

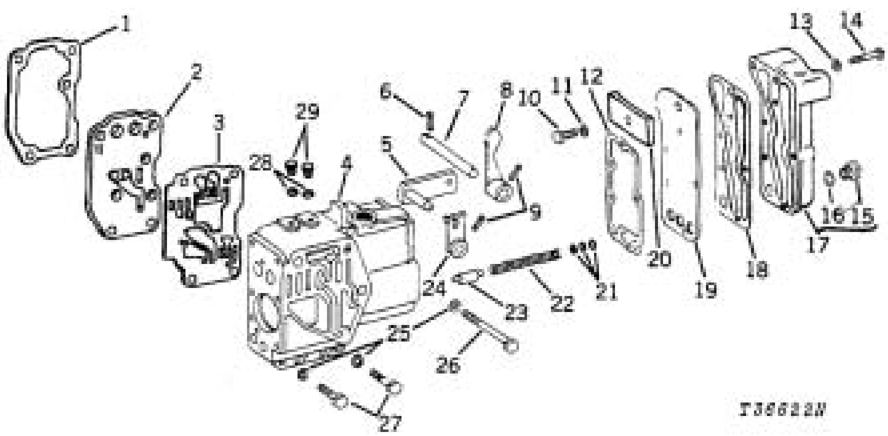
INSTALLATION

Install valve on unit. Be sure area is clean before installation.



1—Cap Screw (6 used)
2—Lock Washer (6 used)
3—Gasket
4—Retaining Ring
5—Retaining Ring (2 used)
6—Pin
7—Clutch Control Valve
8—Spring
9—Stop
10—Valve Housing
11—Oil Seal (2 used)
12—Plug
13—O-Ring
14—Spring
15—Ball
16—Valve
17—Spring
18—Spring
19—Spring
20—Accumulator Piston
21 —Spring Pin
22 —Clutch Pressure Valve
23 —Special Screw
24 —O-Ring
25 —Cover
26 —O-Ring
27 —Plug
28 —O-Ring (2 used)
29 —Plug (2 used)
30A—Cooler Relief Valve (early units)
30B—Cooler Relief Valve (later units)

Fig. 2-Reverser Clutch Control Valve and Piston Assembly

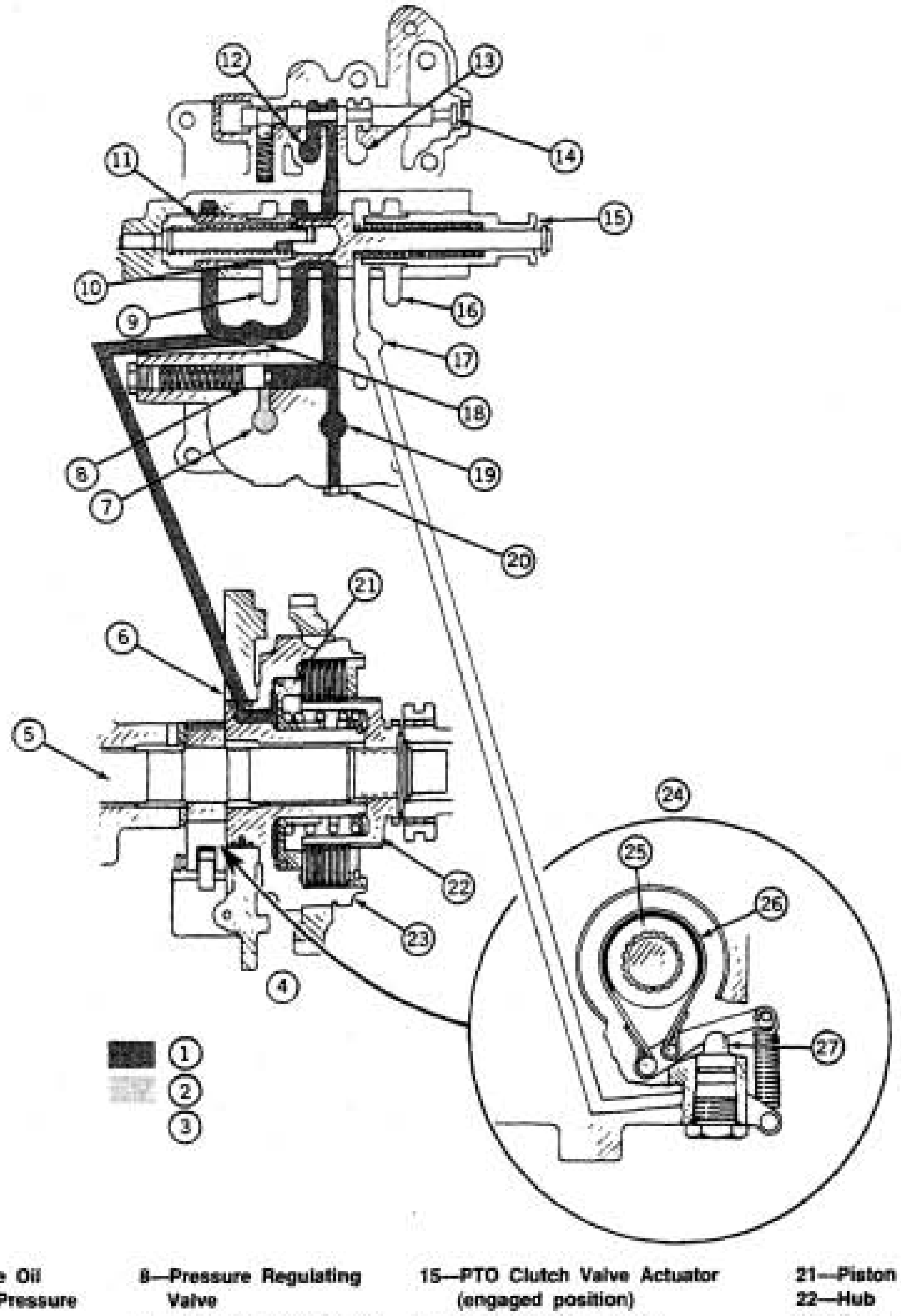


1—Gasket
2—Control Valve Housing Plate
3—Gasket
4—Valve Housing
5—Clutch Control Valve Shaft
6—Spring Pin
7—Shaft
8—Arm
9—Spring Pin
10—Cap Screw
11—Lock Washer
12—Gasket
13—Washer (5 used)
14—Cap Screw (5 used)
15—Plug
16—O-Ring
17—Cover
18—Gasket
19—Plate
20—Block
21—Shim (6 used)
22—Spring
23—Valve
24—Inner Arm
25—Washer (3 used)
26—Cap Screw
27—Cap Screw (2 used)
28—O-Ring (2 used)
29—Plug (2 used)

Fig. 3-Reverser Clutch Control Valve Shaft and Arm Assembly

Group 20
INDEPENDENT PTO CONTROL VALVE

GENERAL INFORMATION



T23379

1—High Pressure Oil
2—Intermediate Pressure Oil
3—Pressure Free Oil
4—PTO Clutch
5—PTO Powershaft
6—Bearing and Manifold Support
7—To Main Pump
8—Pressure Regulating Valve
9—To Sump from Clutch
10—Orifice
11—PTO Clutch Valve
12—To Hi-Clutch
13—To Lo-Clutch
14—Hi-Lo Control Valve
15—PTO Clutch Valve Actuator (engaged position)
16—To Sump from Brake
17—Pressure Port from PTO Brake
18—Pressure Port for PTO Clutch
19—From Transmission Pump
20—Pressure Port for Pressure Regulating Valve
21—Piston
22—Hub
23—Drum
24—PTO Brake
25—PTO Powershaft
26—Brake Band
27—Brake Piston

Fig. 1-Independent PTO Hydraulic Operation

The independent PTO option may be either a single 540 rpm or a dual 540-1000 rpm PTO. A mid 1000 rpm PTO is available with the rear dual option.

Operation of the PTO clutch (mounted ahead of transmission countershaft bearing support) is controlled by a control valve located at the top of the clutch housing in the transmission shifter cover.

In the engage position, the control valve directs pressure oil from the transmission oil pump to the PTO clutch pack, engaging the PTO power train (Fig. 1).

In the disengaged position, the control valve relieves oil from the PTO clutch and directs pressure oil to the PTO brake, stopping the PTO powershaft (Fig. 1).

The control valve assembly contains a modulating-type clutch valve which allows a gradual pressure build-up to the clutch pack for smooth PTO engagement.

This is accomplished as follows:

During the shift to the engaged position, pressure oil is temporarily ported to the rear of the PTO clutch valve preventing a rapid rearward movement of the valve. Then, when hand lever movement overrides this pressure build-up, full movement of the valve to the engaged position is accomplished.

REMOVAL

Clean area around the control valve before removing from the unit.

Remove control valve from the unit.

REPAIR

Refer to Fig. 3 during disassembly and assembly of the valve.

Check the following spring for free length and test length.

Pressure regulating valve spring (24, Fig. 3) free length of 3.00 in [79.0 mm] and test length of 2.56 in. [65.0 mm] with 45 ± 4.5 pounds [20.4 ± 2.0 kg] force.

Clutch valve spring (8, Fig. 3) free length of 1.91 in. [48.5 mm] and test length of 1.33 in. [33.8 mm] with 22.3 ± 2.2 pounds [10.1 ± kg].

Actuator spring (32, Fig. 3) free length of 0.81 in. [20.6 mm] and test length of 0.54 in. [13.7 mm] with 50 ± 5 pounds [22.7 ± 2.3 kg] force.

Actuator valve spring (35, Fig. 3) free length of 0.875 in. [22.2 mm] and test length of 0.625 in. [15.9 mm] with 12 to 15 pounds [5.4 to 6.8 kg] force.

Assemble valve assembly, loading clutch valve spring and valve actuator spring as follows.

ADJUSTMENT

Clutch Valve Spring Guide Pin - install spring (8, Fig 3), three washers (7), and retaining ring (6). Place small O.D. of spring pin (10) on sealer and press with fingers on spring. If spring does not break free from headed end of spring pin at 7 ± 0.5 pound [3.17 ± 0.23 kg] load, add or deduct washers until proper load is obtained (should always have a minimum of one washer).

Clutch Valve - install three washers (34), spring (35), sleeve (36), spring (32), three washers (34), actuator (33), and retaining ring (6). Place clutch valve end on sealer and press with fingers on clutch valve actuator. If clutch valve actuator does not break free from retaining ring end of clutch valve at 13 ± 0.5 pound [5.9 ± 0.2 kg] load, add or deduct washers until proper load is obtained.

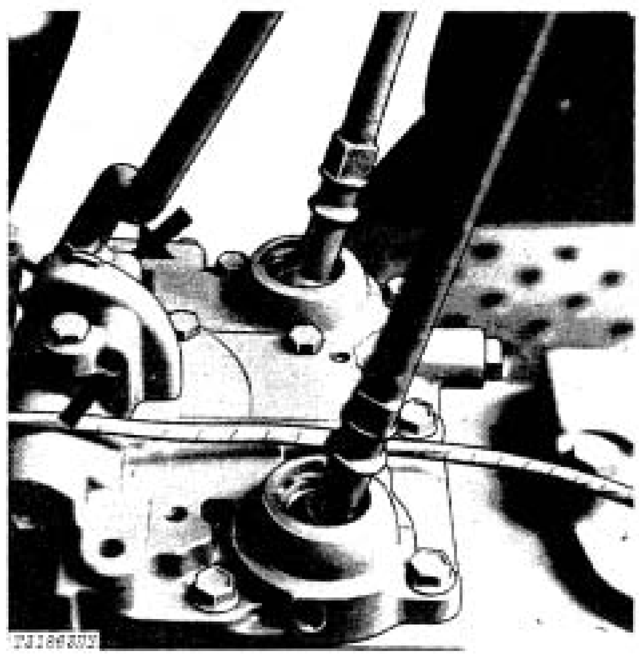
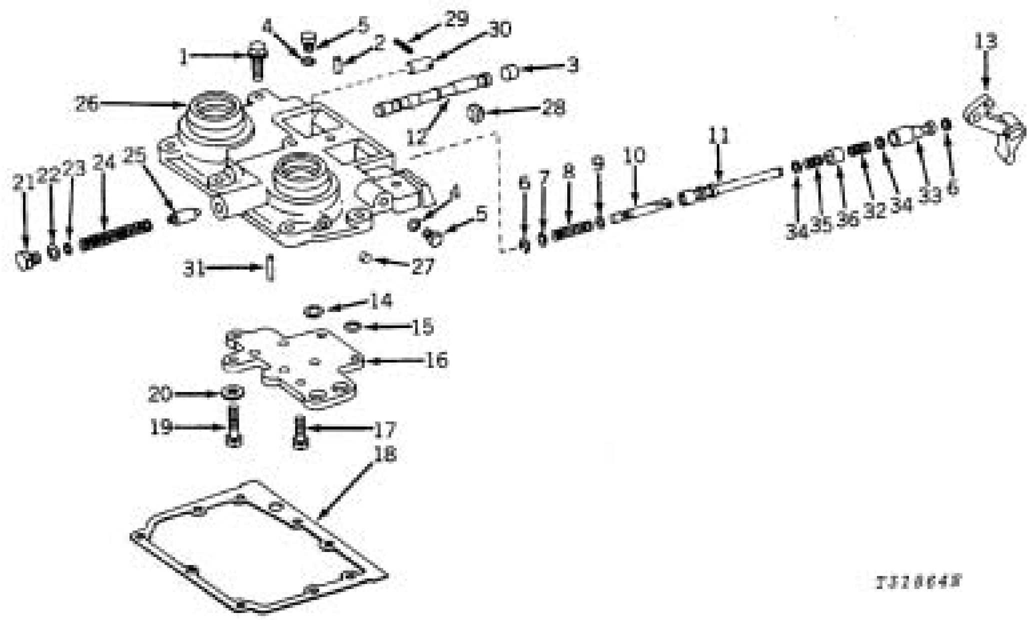


Fig. 2-Adjusting Detent Screws



1—Cap Screw (5 used)
2—Dowel Pin (2 used)
3—Plug
4—O-Ring (3 used)
5—Plug (3 used)
6—Retaining Ring
7—Washer (6 used)
8—Spring (2 used)
9—Washer
10—Pin
11—Valve
12—Clutch Control Valve
13—Control Lever Arm
14—O-Ring (2 used)
15—O-Ring (2 used)
16—Plate
17—Cap Screw (4 used)
18—Gasket
19—Cap Screw
20—Washer
21—Plug
22—O-Ring
23—Washer (3 used)
24—Spring
25—Pressure Regulating Valve
26—Housing
27—Plug
28—Plug
29—Spring Pin
30—Plug
31—Pin
32—Spring
33—Activator
34—Special Washer (6 used)
35—Spring
36—Sleeve

Fig. 3-Clutch Control Valve

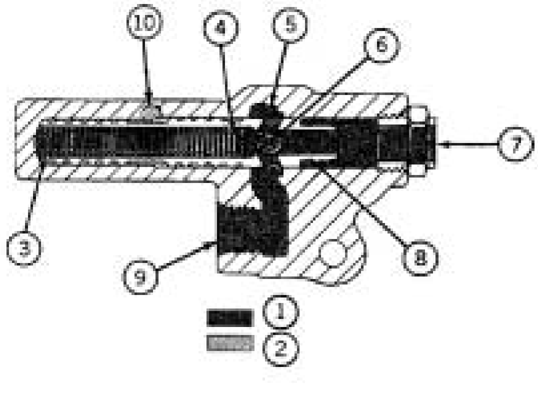
Detents - Adjust detent screw (Fig. 2). Back out detent screws two turns after detent springs are compressed solid.

INSTALLATION

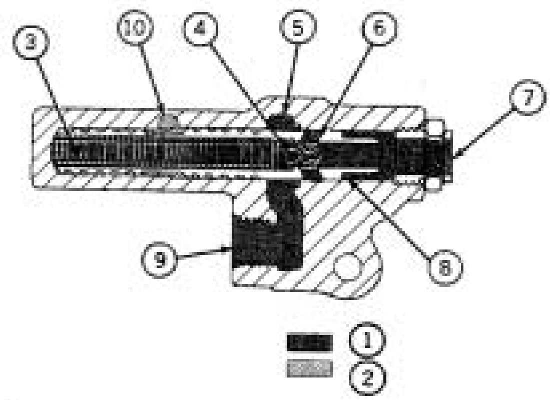
Install valve on unit. Be sure area is clean before installing valve.

Group 25
PRESSURE CONTROL VALVE

GENERAL INFORMATION



OPEN



CLOSED

1—High Pressure
2—Low Pressure
3—Pressure Control Valve Spring
4—Shims
5—Outlet to Rockshaft
6—Orifice
7—Pressure Oil Inlet
8—Pressure Control Valve
9—Outlet to Selective Control Valve
10—Bleed Passage to Transmission Reservoir

Fig. 1-Positions of Pressure Control Valve

The pressure control valve acts as a flow divider and maintains pressure for the hydraulic system. It gives priority to the steering system.

A movable orifice (6, Fig. 1) acts as a pressure sensing device connecting the front and rear of the valve.

The rear portion of the valve (8) is smaller than the front, providing the necessary differential for dividing oil flow properly.

When pressure is equal at both ends, pressure at the larger end will cause the valve to move toward the area having the smaller diameter.

A low pressure leak-off cavity at the middle of the valve housing prevents a hydraulic lock in case of oil leakage past the valve.

FOS

Refer to "Hydraulic Valves" in FOS Manual, "HYDRAULICS" for additional description and theory of operation.

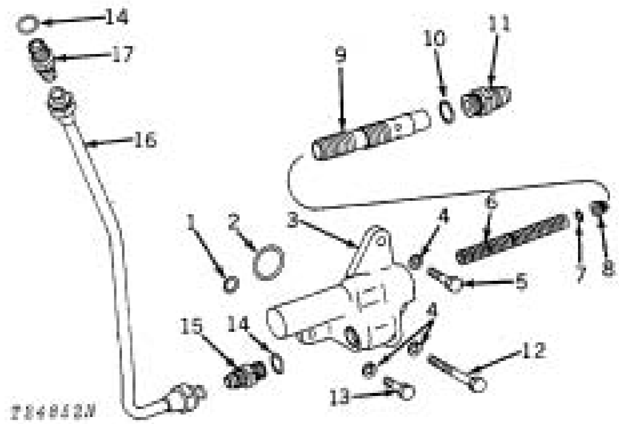
NOTE: On units before serial number 246128, pressure control valve should open at 1700 to 1800 psi (120 to 127 kg/cm²) and on units after serial number 246127, pressure control valve should open at 1600 ± 50 psi. (112 ± 4 kg/cm²).

REMOVAL

Clean area around the pressure control valve before removal.

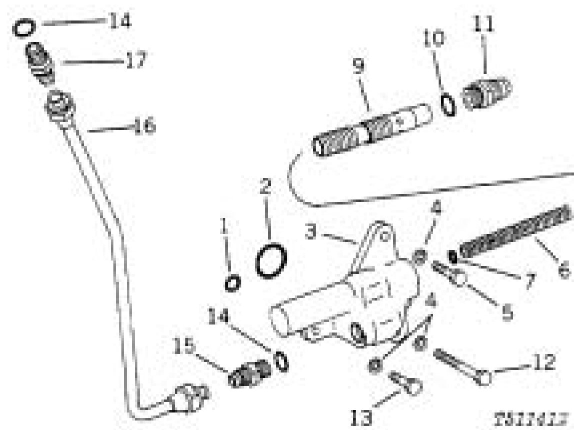
Disconnect lines and remove pressure control valve from unit.

REPAIR



1—O-Ring Packing
2—O-Ring Packing
3—Pressure Control Valve Housing
4—Lock Washer (3 used)
5—Cap Screw
6—Spring
7—Shims (0.030") (2 used)
8—Orifice
9—Pressure Control Valve
10—O-Ring Packing
11—Connector
12—Cap Screw
13—Cap Screw
14—O-Ring Packing (2 used)
15—Connector (with selective control valve)
Plug (without selective control valve)
16—Selective Control Valve Pressure Line
17—Connector

Fig. 2-Pressure Control Valve (-246127)



1—O-Ring Packing
2—O-Ring Packing
3—Pressure Control Valve Housing
4—Lock Washer (3 used)
5—Cap Screw
6—Spring
7—Shims (0.030") (2 used)
8—Orifice
9—Pressure Control Valve
10—O-Ring Packing
11—Connector
12—Cap Screw
13—Cap Screw
14—O-Ring Packing (2 used)
15—Connector (with selective control valve)
Plug (without selective control valve)
16—Selective Control Valve Pressure Line
17—Connector

Fig. 3-Pressure Control Valve (246128-   )

Remove inlet connector (11, Fig. 2 and 3) and slide parts from the housing.

Inspect valve and housing bore.

Test spring (6, Fig. 2 and 3). Spring must have a free length of 4.62 in. [117.3 mm] and a length of 3.50 in. [88.9 mm] with 45 to 55 pounds [20.4 to 24.9 kg].

Examine Control Orifice

Replace same number of shims as removed between spring and orifice. Adding shims will increase the valve pressure setting; deducting shims will decrease the valve pressure setting.

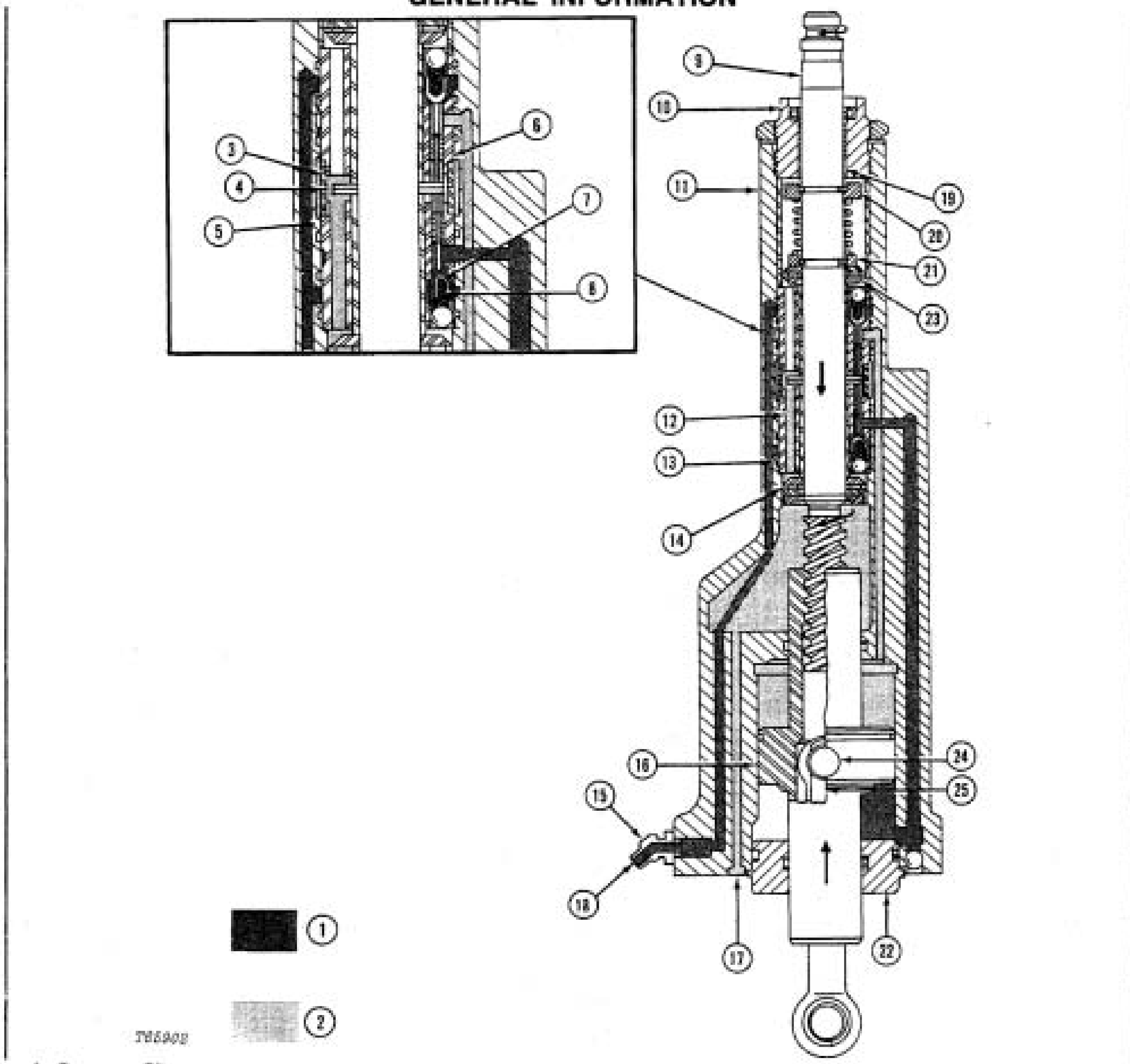
On units before serial number 246128, refer to Fig. 2 during disassembly and assembly of the valve and on units after serial number 246127, refer to Fig. 3 during disassembly and assembly of the valve.

INSTALLATION

Install the pressure control valve on the unit. Be sure oil lines are clean before connecting to the valve.

Group 30
POWER STEERING VALVE

GENERAL INFORMATION



1—Pressure Oil
2—Return Oil
3—Spacer
4—Special Washers
5—Shims
6—Steering Valve Sleeve
7—Steering Valve
8—Spring
9—Steering Wheel Shaft
10—Adjuster
11—Housing
12—Operating Sleeve
13—Steering Valve Body
14—Needle Thrust Bearing
15—Inlet Fitting
16—Piston
17—Return to Transmission Sump
18—Front Hydraulic Pump
19—Sleeve
20—Special Washer
21—Special Washer
22—Piston Guide
23—Needle Thrust Bearing
24—Pin
25—Connecting Rod

Fig. 1-Power Steering - Right Turn

Pressure oil from the main hydraulic pump is supplied to the steering valve housing through a drilled passage in the housing (Fig. 1).

When the steering valves are in neutral (steering wheel motion stopped) the valves are held on their seats by hydraulic and spring pressure so there is no oil flow to either side of the steering piston. (Thus the term "closed center" is used for this steering system.)

A mechanical force from the steering linkage can move the steering piston but a resultant hydraulic force will counteract any piston movement beyond 0.004 inch [0.107 mm].

Right Turn—Power

Right hand rotation of the steering wheel causes the steering wheel shaft to thread into the piston (Fig. 1). The special washers secured to the steering wheel shaft move in a downward direction, contacting the lower steering valve sleeve. The downward sleeve movement pushes the steering valve off its seat and allows pressure oil to flow to the bottom side of the steering piston. This pushes the piston upward causing the tractor to turn right. Oil above the piston is returned to sump through the steering valve sleeve, valve body, and steering valve housing.

The upward movement of the piston will move the steering wheel shaft to a neutral position when steering wheel rotation is stopped. If steering wheel rotation is continued to its maximum travel point, the steering piston will bottom out on the top of the cylinder housing causing the main hydraulic pump to go out of stroke.

The return oil flow through the steering valve housing provides lubrication for the valve housing components and those in the steering and yoke shaft compartment in the clutch housing. The return oil flows into the steering and yoke shaft compartment and out an overflow passage to sump. The overflow passage is on the top surface of the steering and yoke shaft compartment keeping the oil level above the compartment components.

Left Turn—Power

Left hand rotation of the steering wheel causes the steering wheel shaft to thread out of the piston. The special washers secured to the steering wheel shaft move in an upward direction, contacting the upper steering valve sleeve. The upward sleeve movement pushes the steering valve off its seat and allows pressure oil to flow to the top side of the steering piston. This pushes the piston downward causing the tractor to turn left. Oil below the piston is returned to sump through the steering valve sleeve, valve body, and steering valve housing.

The downward movement of the piston will move the steering wheel shaft to a neutral position when steering wheel rotation is stopped.

If steering wheel rotation is continued to its maximum travel point, the steering piston will bottom out on the piston rod guide causing the main hydraulic pump to go out of stroke.

Manual Steering

Manual steering is provided for times when the engine is not running or when there is a malfunction in the hydraulic system. The steering wheel shaft and piston rod provide enough mechanical advantage to steer the tractor.

Turning the steering wheel will actuate the special washers, valve sleeves, and steering valve the same as for a power turn. The vertical thrust is taken up by the needle thrust bearings and valve bodies rather than the special washers and operating sleeves.

As the steering wheel shaft continues to turn, the steering piston will move causing the piston to push oil out of the cylinder, allowing the tractor wheels to turn. The mechanical stops are the same as in the power steering operation.

REMOVAL

Use a puller to remove steering wheel.

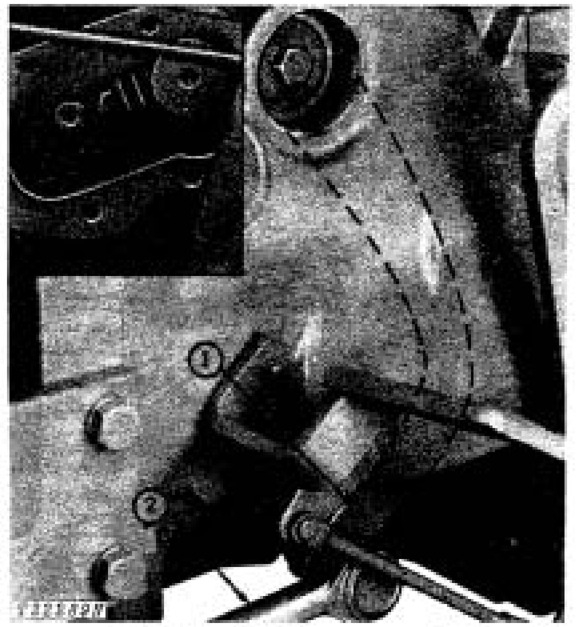
Disconnect inlet pressure line and drain oil at plug on right side of clutch housing.

Remove steering gear shaft and yoke cover and locate steering shaft pin and retainer plate (inset, Fig. 2). Remove retainer plate cap screw and plate. Screw a 3/8-inch cap screw in steering shaft pin and pull pin from steering shaft yoke.

Turn steering wheel from stop to stop to remove oil in the steering cylinder. Have container at drain plug.

Disconnect drag link from steering shaft arm and take out button plug on left side of clutch housing (Fig. 2).

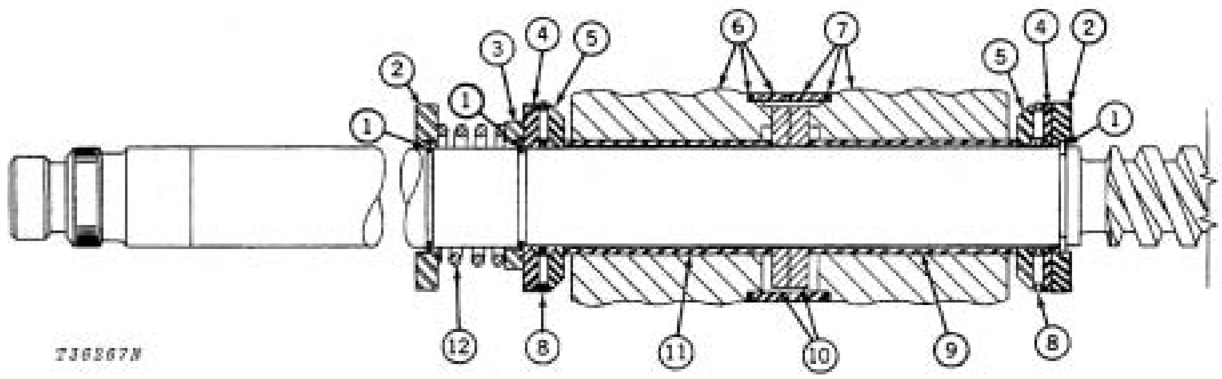
Remove steering shaft arm retaining cap screw and washer. Support steering shaft arm and pull steering and yoke shaft from right side of clutch housing. Remove steering shaft arm.



1—Steering Shaft Arm 2—Drag Link

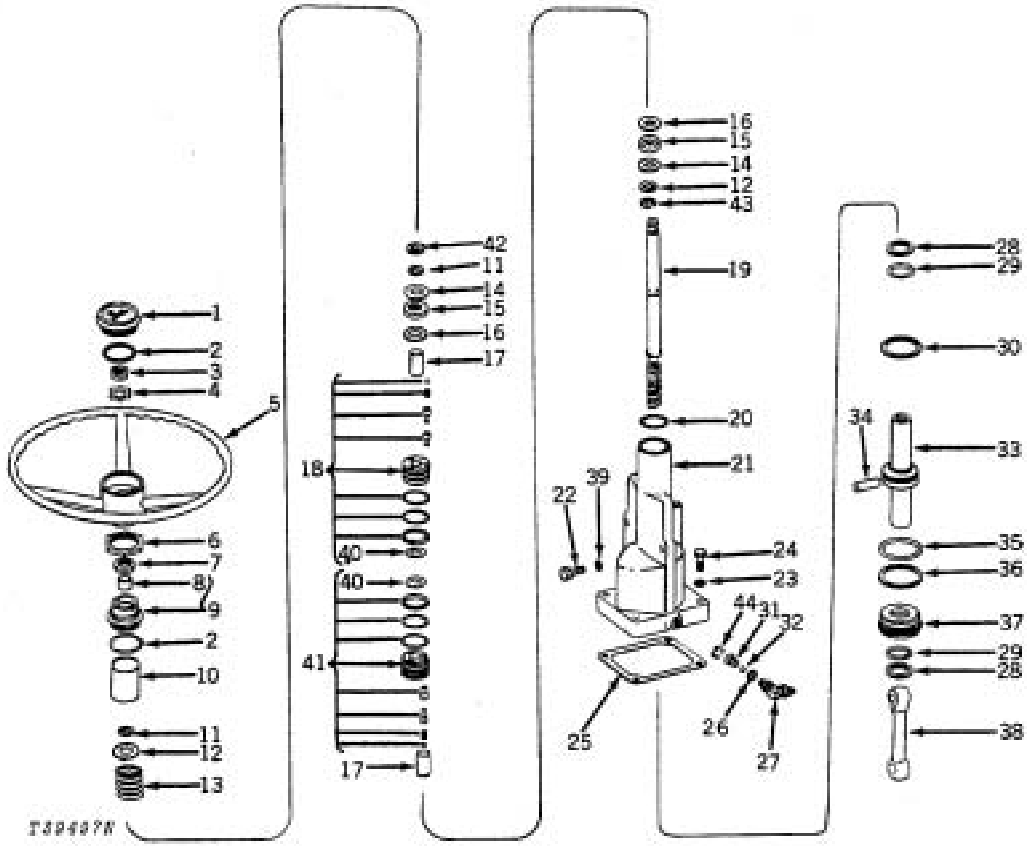
Fig. 2-Removing Steering Assembly

REPAIR



1—Snap Ring (3 used)
2—Special Washer (2 used)
3—Special Washer
4—Thrust Washer (2 used)
5—Thrust Washer (2 used)
6—Upper Valve Body Assembly with Spacer and Shims
7—Lower Valve Body Assembly with Spacer and Shims
8—Thrust Bearing (2 used)
9—Lower Operating Sleeve
10—Special Washers
11—Upper Operating Sleeve
12—Spring

Fig. 3-Cutaway of Power Steering Valve Shaft and Body Assemblies



1—Steering Wheel Emblem
2—O-Ring (2 used)
3—Hex. Jam Nut
4—Special Lock Washer
5—Steering Wheel
6—Special Jam Adjuster Nut
7—Oil Seal
8—Bushing
9—Steering Wheel Shaft Adjuster
10—Sleeve
11—Snap Ring (2 used)
12—Special Washer (2 used)
13—Spring
14—Special Thrust Washer (2 used)
15—Needle Bearing (2 used)
16—Special Thrust Washer (2 used)
17—Sleeve (2 used)
18—Steering Valve Body (Upper)
19—Steering Wheel Shaft
20—O-Ring (6 used)
21—Steering Valve Housing
22—Cap Screw (2 used)
23—Lock Washer (4 used)
24—Cap Screw (4 used)
25—Gasket
26—O-Ring
27—90° Adjustable Elbow
28—Backup Ring (2 used)
29—O-Ring (2 used)
30—Sealing Ring
13—Spring
32—Check Ball
33—Piston
34—Pin
35—O-Ring
36—Backup Ring
37—Piston Rod Guide
38—Steering Connecting Rod
39—Lock Washer (2 used)
40—Special Washer (2 used)
41—Steering Valve Body (Lower)
42—Special Washer
43—Snap Ring
44—Retainer

Fig. 4-Power Steering Valve

Refer to Figures 3 and 4 and do the following:

Remove steering valve adjuster nut. Using a spanner wrench, remove steering wheel shaft adjuster and oil seal. Use JDH-41-2 special tool to remove adjuster.

Slide sleeve from housing.

Turn the steering wheel shaft clockwise until the piston contacts the upper end of the cylinder. While restricting the connecting rod from either turning or moving downward, turn the steering wheel shaft counterclockwise until the acme threads on the shaft and in the steering piston are disengaged.

Remove the piston assembly and piston rod guide from the housing.

Carefully remove the steering wheel shaft and attached parts from the housing.

NOTE: To disassemble parts on shaft, use JDH-41-1 special tool and CAREFULLY compress spring until top snap ring is free.

Remove upper snap ring, by pressing down on snap ring retaining washer against spring. Remove special washers, spring and thrust washer. Remove second snap ring, needle thrust bearing with thrust washers, upper valve body assembly including the upper spacer and shims, upper operating sleeve, two special washers, lower valve body with lower spacer and shims, lower operating sleeve, and needle thrust bearing with thrust washers.

The valve body assemblies are factory assembled and adjusted units. Special care should be used to identify the upper spacer and shims, upper special washer, and steering valve sleeve from the lower components. Any switching of these components from one valve body assembly to another could result in a steering system malfunction.

Use a spanner wrench with a dowel pin head or a strap wrench to remove the piston from the piston rod.

Press pin from piston rod and remove connecting rod.

Inspect oil seal (7, Fig. 4) in adjuster for damage or deterioration.

Before installing new oil seal, check adjuster bushing (8) for wear. If necessary, remove old bushing and drive new bushing flush with top of chamfer in top side of adjuster using an M618 driver.

Drive new oil seal in adjuster (sealing lips facing inward) using flat back side of AM553 driver.

Examine thrust washers (14 and 16) and needle thrust bearings (15) for worn or damaged condition.

Check steering valve sleeves and special washers in valve body assemblies (18 and 41) for damage such as excessive distortion or wear.

IMPORTANT: Valve body assembly must be replaced as a unit of matched parts.

Inspect steering wheel shaft (19) for damage. Check threads on shaft for wear or rough spots.

Check steering piston (33) for excessive wear or damage. If piston is unserviceable, replace with a new part.

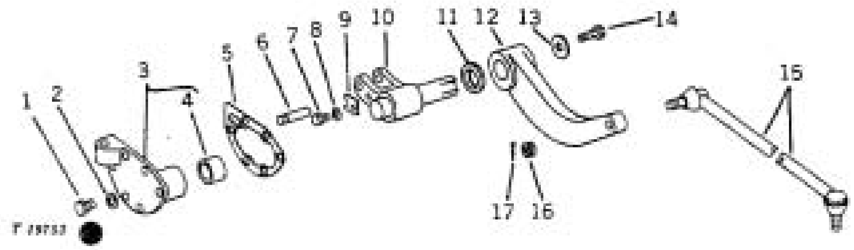
Replace sealing ring (30) on piston.

Check steering piston rod guide (37) for damage or wear especially in area of piston rod hole.

Inspect connecting rod (38) for damage. Replace if damage is evident.

Check steering valve housing for damage. Thoroughly clean housing, especially internal portion. Be sure all oil passages are open. Use compressed air to dry and clean housing.

Lower Steering Linkage



1—Cap Screw (6 used)
2—Lock Washer (6 used)
3—Cover
4—Bushing
5—Gasket
6—Pin
7—Cap Screw
8—Lock Washer (internal tooth)
9—Pin Plate
10—Steering Shaft
11—Oil Seal
12—Steering Arm
13—Washer
14—Cap Screw
15—Drag Link
16—Slotted Nut (2 used)
17—Cotter Pin (2 used)

Fig. 5-Power Steering Arm and Drag Link

Refer to Fig. 5 as a parts guide.

Inspect steering gear shaft and yoke cover for damage. Replace if necessary.

Examine bushing (4) in steering gear shaft and yoke cover for wear or damage. If replacement is required, use OTC tool No. 252 to press in bushing flush to 0.0300 in. [0.76 mm] below face of bore.

Check bushing at opposite end of steering and yoke shaft on left side of clutch housing in knockout plug opening. If required, press in new bushing flush to 0.0300 in. [0.76 mm] below face of bore.

Inspect the steering arm (12) to see if it has been rubbing against the clutch housing. If it shows signs of rubbing, grind the high spots off of the steering arm.

Inspect steering and yoke shaft (10) for damage. Replace if necessary.

Check steering and yoke shaft oil seal (11) on left side of clutch housing for damage or deterioration.

Apply Loctite Plastic Gasket or equivalent to bore in clutch housing before installing oil seal. Install new oil seal in clutch housing with sealing lips facing bottom of oil seal bore and opposite side flush with bottom of oil seal bore chamfer. Use OTC No. 27797 driver set for this installation.

Inspect drag link (15) for damaged or bent condition. Replace if necessary.

ASSEMBLY

Replace all O-rings and backup rings when reassembling the power steering assembly. Dip all internal parts in oil before assembly.

Place connecting rod (small end first) in open end of steering piston rod. Connect to piston rod with pin. Press pin to flush with outside surface of piston rod.

Install sealing ring in groove on piston.

Stack parts on steering wheel shaft as follows:

Slide special washer over shaft then slide lower needle thrust bearing with thrust washers over shaft.

Be sure to install thrust washer so large chamfered surface will be toward the lower valve body.

Install lower operating sleeve, lower valve body with lower spacer, and shims.

Place the two special washers over the shaft. Then install upper operating sleeve, upper spacer, shims, and upper valve body.

Slide upper needle thrust bearing and thrust washers onto shaft.

Install snap ring.

Be sure to install thrust washer so large chamfered surface is toward the upper valve body.

Install thrust washer spring and snap ring retaining washer.

Install snap ring on shaft and push down into groove.

Slide piston rod guide onto piston rod and install in steering valve housing.

Fit steering wheel shaft and components into housing and thread shaft into the piston rod. Install sleeve (10, Fig. 4) over shaft.

Install O-ring on adjuster (with bushing and oil seal). Coat seal lips with Lubriplate or equivalent before installing adjuster. Coat adjuster bushing with grease. While protecting seal with suitable sleeve, slip adjuster over end of steering wheel shaft and screw adjuster into valve housing.

Using a spanner wrench, tighten adjuster to 50 lb-ft [6.913 kg-m]. Hold adjuster with spanner wrench and tighten lock nut to 30 lb-ft. [4.15 kg-m].

INSTALLATION

NOTE: When installing steering arm (12, Fig. 5), discard the old D grade cap screw (14) and washer (13) and replace with F grade cap screw 19H2710 and T42971 Special Washer.

Slip steering shaft arm into clutch housing.

Align punch mark on steering and yoke shaft (adjacent to one of the splines) with punch mark on steering arm (on boss between two splines) and place steering and yoke shaft into position. Grease splined end of steering and yoke shaft and coat lips of oil seal with Lubriplate or equivalent prior to pushing shaft through bore containing oil seal. Loosely secure arm to shaft with a cap screw and washer.

After installing steering gear shaft and yoke cover, tighten arm-to-shaft cap screw to 190 lb-ft. [26.26 kg-m]. Strike arm with a hammer and again tighten to 190 lb-ft [26.26 kg-m].

When assembling new parts, an interference fit must exist between the steering shaft (10, Fig. 5) and the steering arm (12) through approximately one half of the engagement. When assembling used parts, it is acceptable if an interference fit exists through any part of the engagement.

Using a new gasket, position steering valve over yoke compartment in clutch housing and secure with attaching hardware.

Attach connecting rod to steering shaft yoke and lock pin with retainer (inset, Fig. 3).

Using a new gasket, install steering gear shaft and yoke cover.

Connect pressure oil line to steering valve and return oil line to fitting on steering yoke and shaft cover.

Install steering wheel and turn from stop to stop, counting number of turns (approximately 3-1/2 turns). Turn steering wheel back half this number of turns. Reinstall steering wheel so that a spoke is on vertical center-line pointing downward. Install special washer around hex. nut. Tighten steering wheel hex. nut to 50 lb-ft [6.91 kg-m]. Center and install steering wheel emblem.

Drag link should index with steering shaft arm when wheels are in straight ahead position.

Tighten drag link-to-steering shaft arm nut to 55 ft-lbs [7.60 kg-m]. Advance nut to line up slot and hole in rod end and install cotter pin.

Adjust tie rods to obtain straight ahead position with drag link installed in steering shaft arm.

Check front wheel toe-in adjustment (Section 70).

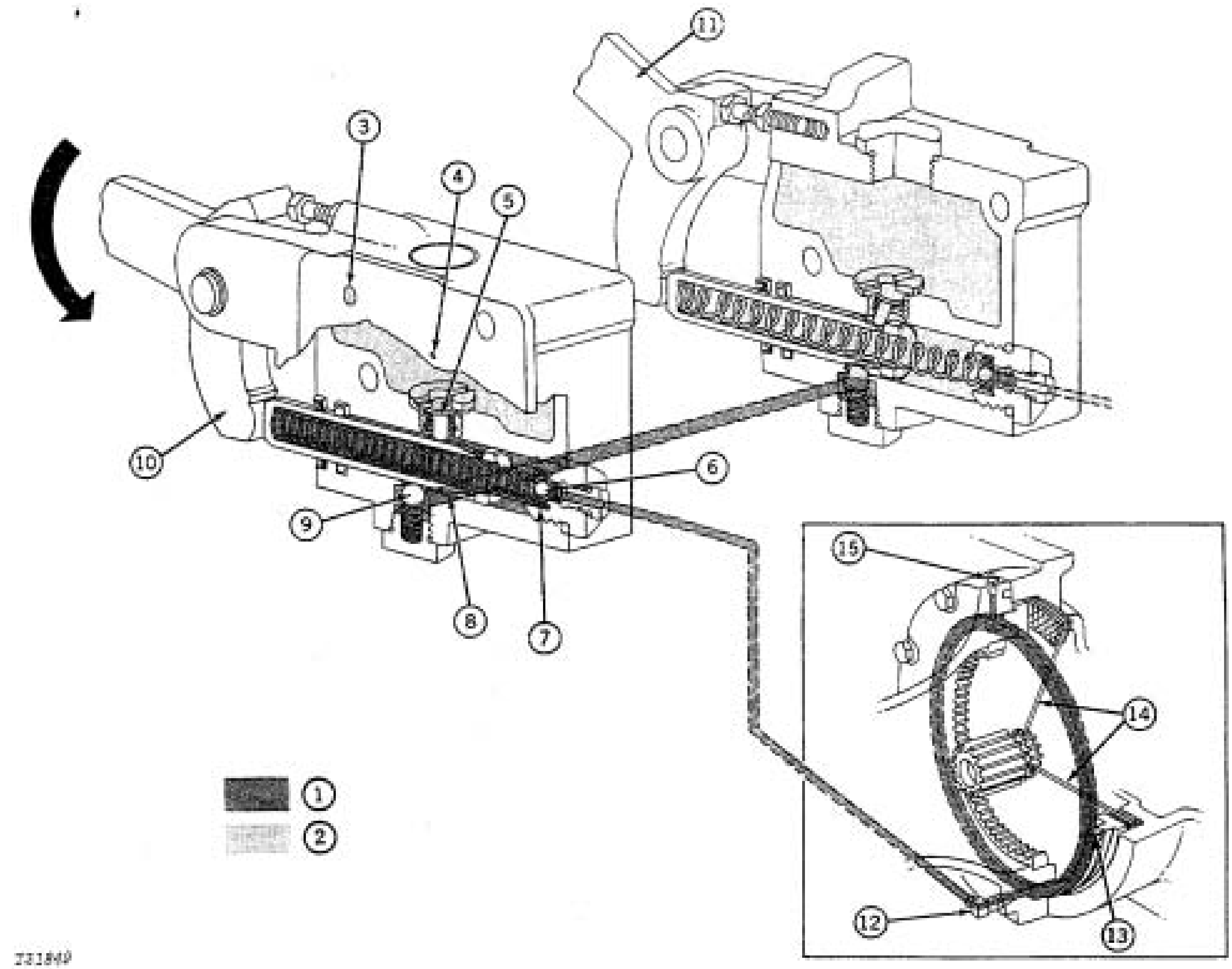
Turn steering wheel to full left and right. Stops on axle knuckles should not contact stops on their respective knees. If stops do contact each other, readjust tie rods for straight ahead position and correct toe-in.

Group 35
MANUAL STEERING

See Section 60, Group 5 for information on manual steering.

Group 40
BRAKE VALVE

GENERAL INFORMATION



1—Pressure Oil
2—Low Pressure Oil
3—Brake Valve Reservoir Bleed Hole
4—Brake Valve Reservoir Inlet Hole
5—Reservoir Check Valve
6—Brake Line Check Ball (early units)
7—Retainer (early units)
8—Piston
9—Equalizing Valve
10—L.H. Brake Pedal
11—R.H. Brake Pedal
12—Hydraulic Brake Oil Inlet Fitting
13—Brake Pressure Plate
14—Brake Disk
15—Brake Bleed Screw

Fig. 1-Individual Hydraulic Brake Operation

The hydraulic brakes are served by the main closed-center constant pressure hydraulic system.

FOS

For additional basic hydraulic brakes information refer to FOS Manual—HYDRAULICS.

The hydraulic brake assembly is activated by two brake pedals, allowing individual or simultaneous operation of the hydraulic brake pressure plates located in annular cylinders in each final drive housing.

Braking is fully hydraulic with no mechanical connection between the valve and cylinders.

The brake valve reservoir is filled with oil by the transmission oil pump via the transmission lubrication circuit.

As long as there is oil in the brake valve reservoir, hydraulic braking is possible with the engine either running or stopped.

Individual Braking

The brake valve reservoir is filled with oil from the transmission oil pump lube circuit through inlet hole (4). Because the flow of oil is continuous, excess oil is dumped through bleed hole (3) to the main hydraulic oil reservoir. When both brake pedals are released, reservoir check valves (5) are unseated and the brake valve cylinders are filled with oil from the brake valve reservoir.

As a brake pedal is depressed, its respective brake valve piston (8) is moved rearward against spring pressure and against oil in the cylinder. As the piston continues to move rearward it closes the reservoir check valve (5) sealing off the cylinder from the reservoir. Oil is then pushed out of the valve cylinder, unseating brake line check ball (6) (early units). The oil moves through a brake line to the rear axle housing and applies a force against the pressure plate (13). This compresses the revolving brake disk (14) and the brake facing (15) between the pressure plate (13) and the transmission case, causing a braking action.

When the brake pedal is released, the force against the pressure ring is relieved. The oil returning from the rear axle housing is metered by the brake line check valve (6) assuring a governed rate of pedal return. The brake line check valve is not used on later units.

Equalized Braking

As either brake pedal is depressed, movement of the brake piston (8) unseats equalizing valve (9) on the bottom of the brake housing, opening a passage to the other brake cylinder, where oil flow is stopped by the closed equalizing valve.

When both pedals are depressed simultaneously, the equalizing valves (9) on both brake cylinders are opened and connected by a drilled passage in the valve housing. Pressure oil in the two brake cylinders is thus equalized by oil in this passage and even braking is accomplished.

Braking With Engine Stopped

Hydraulic braking with the tractor engine stopped (transmission lubricating system not in operation) is possible if there is an adequate quantity of oil in the brake reservoir. The operation of the brake valve is the same as that previously described.

REMOVAL

Disconnect hydraulic brake lines from valve and remove valve from unit.

REPAIR

Refer to Fig. 2 and do the following:

Remove brake pedals.

Remove brake line connectors and allow brake line check balls and springs to fall free of valve. Remove brake line check valve seats and check ball retainers.

Push brake pistons and piston return springs (protruding from front of valve) out of the rear ports in valve.

Remove reservoir filler plugs from top of valve to gain entry to reservoir check valves.

Using a screwdriver with a bit that fits milled slot in check valve seat, remove both reservoir check valves.

Remove equalizing springs and balls from bottom of valve.

Check brake valve housing (43) for cracks or damage, especially at the two brake cylinder bores. Carefully inspect equalizing ball seats for foreign matter or damage. Replace housing if necessary.

Replace O-ring packings (21) located in each cylinder bore. Dip new packings in oil before installation.

Examine oil seals (20) on outer end of each brake cylinder. If seals require replacement, coat lips of seals with oil. Install oil seals with sealing lips facing outward.

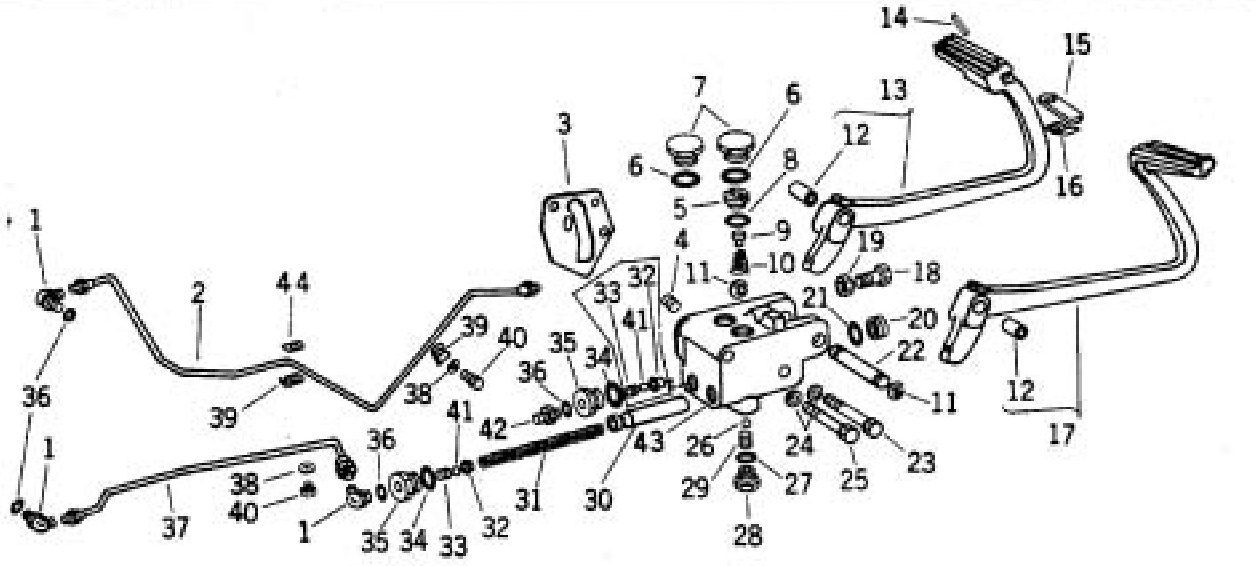
Inspect brake pistons (30) for wear or damage. Wash pistons in solvent and replace if necessary.

Check piston springs (31) for wear or broken coils. Test springs for free length of 7.50 in. [190.50 mm] and a length of 5.75 [146.05 mm] when compressed with 20 pounds [9.07 kg] force.

Examine reservoir check valve (9) for damage or wear, especially in the area where the piston contacts the valve. Replace valve if necessary.

Inspect reservoir check valve springs (10) for damaged or worn coils. Test springs for free length of 0.80 in. [20.32 mm] and a length of 0.28 in. [7.11 mm] when compressed with 0.15 pounds [0.07 kg] force.

Check brake pedal bushings (12) for wear or scoring. Remove old bushings and install new bushings flush with outside edges of brake pedals.



1—90° Elbow (3 used)
2—Left-Hand Brake Oil Line
3—Gasket
4—Plug
5—Reservoir Check Valve Seat (2 used)
6—O-Ring Packing (2 used)
7—Filler Plug (2 used)
8—O-Ring Packing (2 used)
9—Reservoir Check Valve (2 used)
10—Spring (2 used)
11—Retaining Ring (2 used)
*Brake Valve Overhaul Kit
12—Bushing (2 used)
13—Left-Hand Brake Pedal
14—Spring Pin
15—Bar
16—Leaf Spring
17—Right-Hand Brake Pedal
18—Cap Screw (2 used)
19—Hex. Jam Nut (2 used)
20—Oil Seal (2 used)*
21—O-Ring Packing (2 used)*
22—Brake Pedal Shaft
23—Cap Screw
24—Lock Washer (2 used)
25—Cap Screw
26—Ball (2 used)
27—O-Ring Packing (2 used)
28—Plug (2 used)
29—Spring (2 used)
30—Brake Piston (2 used)
31—Piston Spring (2 used)
32—Retainer (2 used) (early units)
33—Spring (2 used) (early units)
34—O-Ring Packing (2 used)*
35—Brake Line Check Valve Seat (2 used)
36—O-Ring Packing (4 used)
37—Right-Hand Brake Oil Line
38—Lock Washer (2 used)
39—Clamp (2 used)
40—Cap Screw (2 used)
41—Ball (2 used) (early units)
42—Connector
43—Brake Valve and Cylinder Housing
44—Plate

Fig. 2-Brake Valve and Cylinder Housing

Dip all O-rings, valves, and pistons in oil before assembly.

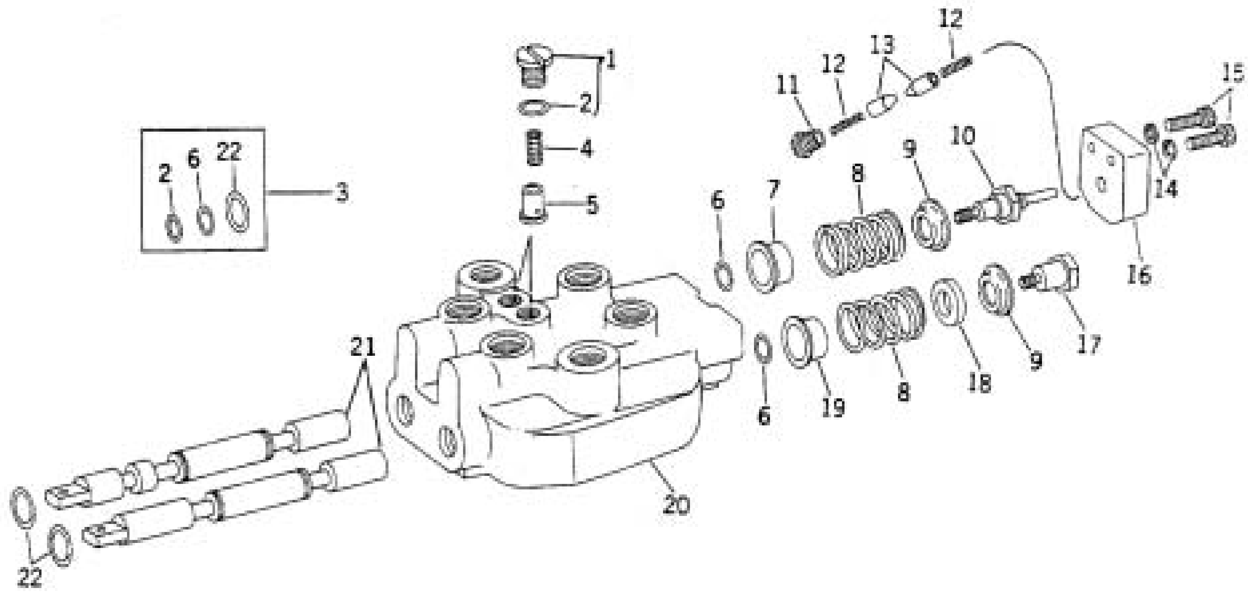
INSTALLATION

Using a new gasket, install brake valve on tractor. Connect all hydraulic brake lines.

When assembling brake pedal (13, Fig. 2) install leaf spring (16) in front of the brake pedal lock bar.

Group 45
LOADER CONTROL VALVE

GENERAL INFORMATION



1—Plug (2 used)
2—O-Ring (2 used)
3—Repair Kit
4—Spring (2 used)
5—Lift Check Plunger (2 used)
6—O-Ring (2 used)
7—Deep Washer
8—Spring (2 used)
9—Shallow Washer (2 used)
10—Spool Detent Screw
11—Detent Pawl Plug
12—Spring (2 used)
13—Detent Pawl (2 used)
14—Lock Washer (2 used)
15—Socket Head Screw (2 used)
16—Detent Block
17—Spool Screw
18—Washer
19—Deep Washer
20—Body
21—Spool (2 used)
22—O-Ring (2 used)

Fig. 1-Loader Control Valve

The loader control valve is a closed center, two spool valve. The boom and bucket sections are contained in a single body.

FOS

See "Hydraulic Valves" in FOS Manual - "HYDRAULICS" for additional description and theory of operation.

REMOVAL

Refer to **Fig.** 1 for identification and relative position of parts.

Operate control valve lever until all hydraulic pressure is relieved.

If loader control valve is to be removed for servicing and it is believed that fragments of failed parts may have entered the loader hydraulic system, completely drain the system and replace the hydraulic filters.

REPAIR

The valve body and spools are matched. Note which spool was removed from which bore for assembly.

Clean and dry all parts thoroughly and inspect for wear or damage.

Discard old O-rings and use new kit when assembling.

Check valve housing for damage or evidence of leakage. Remove burrs from spool parts with fine emery cloth. If spools are worn or damaged, replace spool and valve housing as a matched assembly.

Check lift check springs for a free length of 0.692 in. [17.58 mm] and a test length of 0.625 in. [15.87 mm] with 0.71 to 0.79 pounds [0.32 to 0.36 kg].

Thoroughly clean and dry all parts. Oil all parts lightly prior to assembly.

Replace all O-rings with new parts.

Install spools in proper valve section.

Inspect control valve linkage for worn or damaged parts.

Coat linkage parts with grease before assembling.

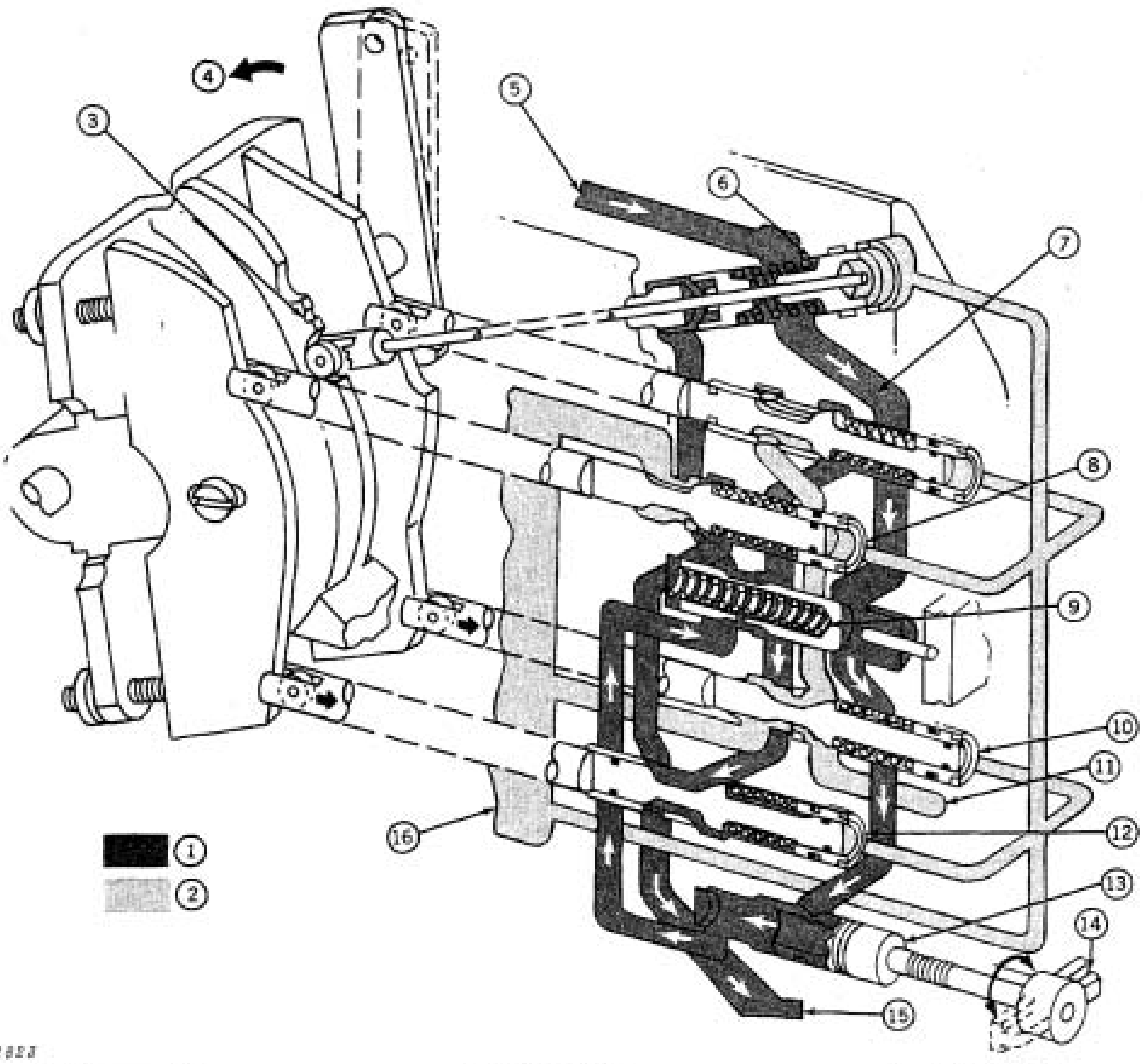
INSTALLATION

Install control valve on loader and connect linkage and oil lines. Tighten cap screws to 13 ± 2 lb-ft (2 ± 0.3 kg-m)

Run loader to check for proper operation and leaks.

Group 50
SELECTIVE CONTROL VALVE

GENERAL INFORMATION



T31823

1—Pressure Oil
2—Return Oil
3—Neutral Detent
4—Extend
5—From Pump
6—Detent Piston
7—Pressure Valve
8—Return Valve
9—Flow Control Valve
10—Return Valve
11—From Coupler
12—Pressure Valve
13—Metering Valve
14—Full Flow
15—To Coupler
16—Sump

Fig. 1-Selective Control Valve (Fast Extend Illustrated)

The unit may be equipped with one selective control valve.

The selective control valve will operate single- or double-acting cylinders and provides a full range of remote cylinder extending and retracting speeds.

The selective control valve is operated by a control lever which has four detented positions: (1) neutral; (2) extend; (3) retract; and (4) float.

The lever will detent in the selected position until the end of the cylinder stroke when it automatically returns to neutral. In float position, the lever must be manually unlocked.

Neutral Position

In neutral position, pressure is equal on both sides of the metering valve. The valve springs hold the valves on their seats, trapping the return oil and holding the remote cylinder in the position it was in prior to "neutral."

Extend Position

Moving the control lever rearward opens one return valve and one pressure valve (Fig. 1).

The return valve opens before the pressure valve to allow return oil from the cylinder to flow to reservoir.

Opening the pressure valve causes a pressure drop in the circuit behind the metering valve.

The flow control valve senses this pressure drop in the circuit and controls the oil flow to the opened pressure valve. The detent-piston also senses this pressure drop and is moved into a notch in the detent rocker due to the pressure differential between both ends of the piston.

When the cylinder reaches the end of its stroke, a pressure build-up occurs on the back side of the flow control valve and opened pressure valve. With pressure now equal on both ends of the detent piston, the pressure build-up behind the pressure valve plus spring pressure moves the operating cams and detent rocker, returning the valves to neutral.

Retract Position

Operation for retract is the same as for extend, except that the opposite return and pressure valves are opened.

Float Position

In the float position the operating cams move the return valves off their seats, leaving the pressure valves closed.

Oil is now free to flow from one end of the cylinder to the other through the selective control valve, giving a floating action to the cylinder piston.

Spring pressure against the pressure valves, plus the slope of the operating cams, hold the valves in float position until they are manually released.

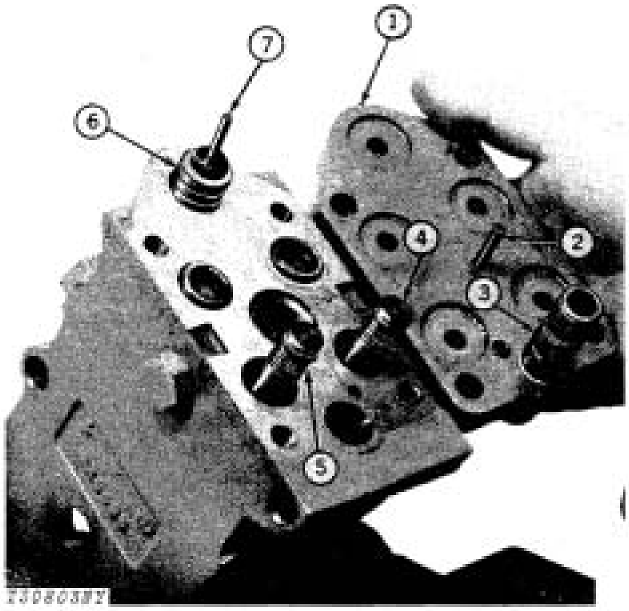
REMOVAL

Relieve hydraulic pressure and remove valve from unit.

Check valve adjustment using the procedure on page 50-50-7.

REPAIR

Refer to Fig. 4 for disassembly and assembly of the valve.



1—Valve Cap
2—Flow Control Valve Stop Pin
3—Metering Valve
4—Return Valve
5—Pressure Valve
6—Detent Piston
7—Detent Piston Pin

Fig. 2—Cap Removal

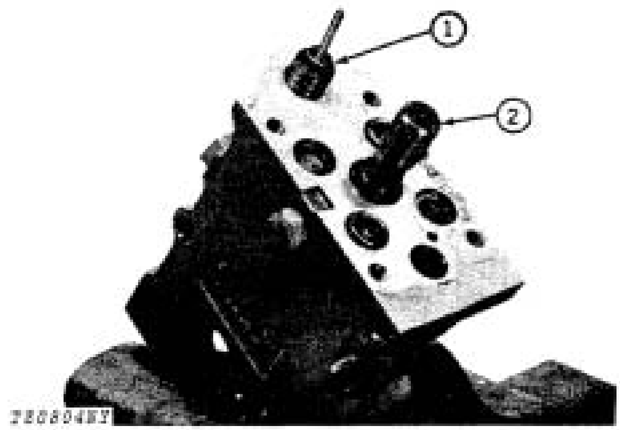
CAUTION: Poppet valve springs are compressed. Carefully remove valve cap. If springs momentarily hang up in housing and then release, the valve guides can be propelled from the housing with considerable force.

Remove valve cap (Fig. 2) from valve housing.

Remove O-rings, valve guides, springs, pressure and return valves (Fig. 2).

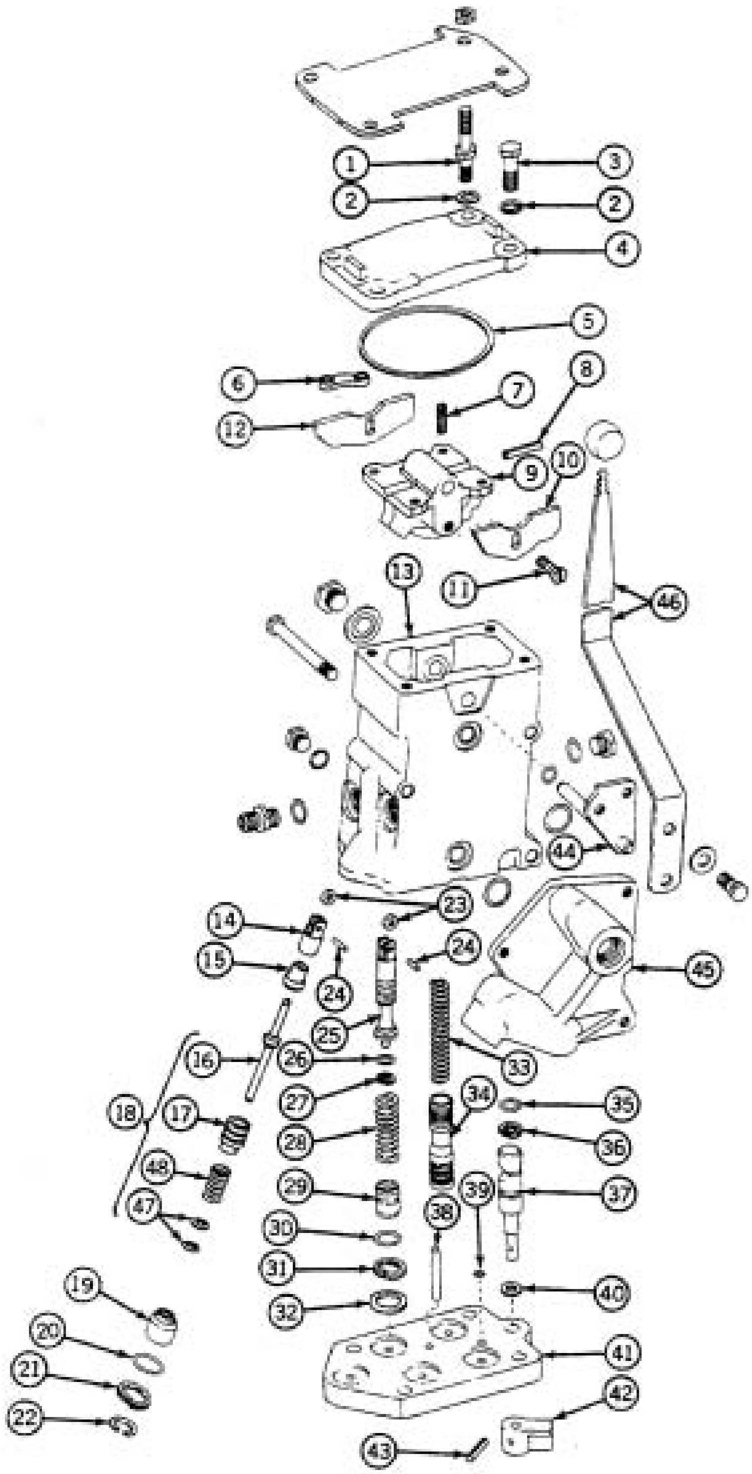
Remove flow control valve (Fig. 3) and spring. Remove snap ring, outer detent piston guide, backup ring, O-ring, and detent piston.

To remove outer detent piston guide, it may be necessary to first remove the rocker assembly and detent follower. Then, push on the detent pin to remove pin, piston, spring and outer guide.



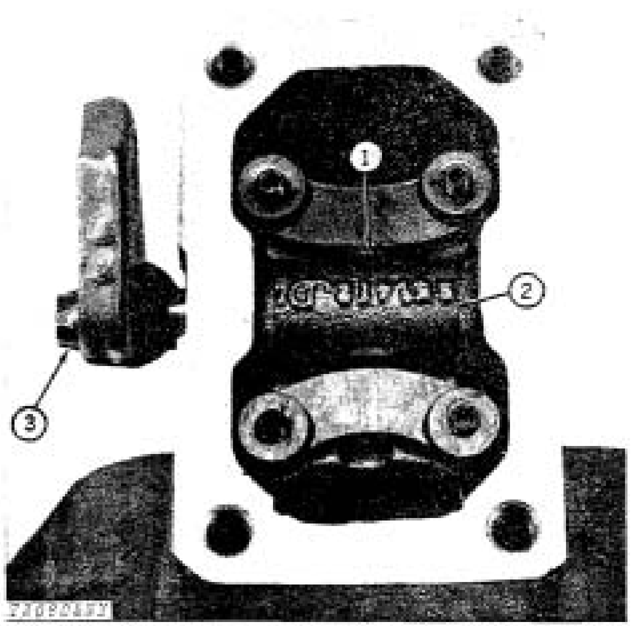
1—Detent Piston **2—Flow Control Valve**

Fig. 3—Flow Control Valve Removal



1—Screw (2 used)
2—Lock Washer (4 used)
3—Cap Screw (2 used)
4—Cover
5—Packing
6—Keeper (2 used)
7—Set Screw (4 used)
8—Spring Pin
9—Rocker
10—Cam
11—Screw (2 used)
12—Cam
13—Housing
14—Cam Follower
15—Guide
16—Detent Pin
17—Detent Piston
18—Detent Assembly
19—Guide
20—O-ring
21—Backup Ring
22—Snap Ring
23—Rollers (5 used)
24—Spring Pin (5 used)
25—Valves (2 Return) (2 Pressure)
26—O-Ring (2 Return) (4 Pressure)
27—Backup Ring (2 Return) (4 Pressure)
28—Spring (2 Return) (2 Pressure)
29—Guide (4 used)
30—O-Ring (4 used)
31—Backup Ring (4 used)
32—Packing (6 used)
33—Spring
34—Flow Control Valve
35—O-Ring
36—Backup Ring
37—Metering Valve
38—Spring Pin
39—O-Ring
40—Thrust Washer
41—Cap
42—Adjusting Arm
43—Spring Pin
44—Arm and Shaft
45—Cover
46—Lever
47—Special Washer (2 used)
48—Spring

Fig. 4-Selective Control Valve



1—Pin
2—Rocker
3—Control Shaft

Fig. 5-Rocker Assembly Removal

Rotate valve housing in vise so rocker assembly (Fig. 5) faces upward.

Drive out pin holding control arm shaft to the rocker assembly. Remove cam holding screws and remove rocker assembly from housing. Remove valve operating cams. Note assembled position of these parts for assembly.

If necessary, remove inner detent guide by removing follower and driving out guide with a brass drift.

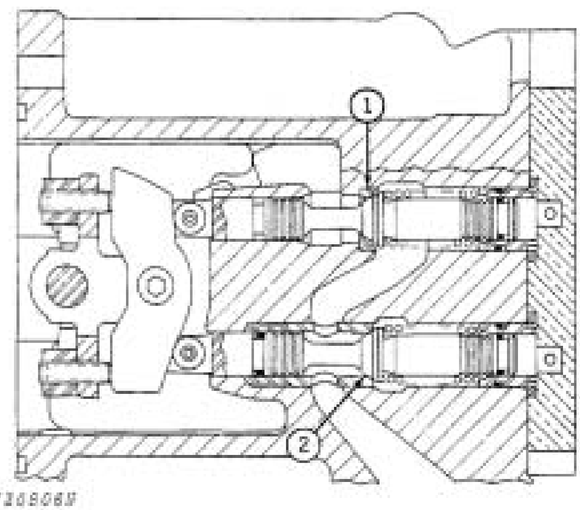
Inspect cap (41, Fig. 4) for damage. Replace if cracked.

Replace flow control valve stop pin (25) if damaged. Be sure that pin's exposed length is 0.9375 in. [23.812 mm] from cap. A pin that is too short can cause jerky valve operation.

Inspect housing for wear or damage. Remove nicks and burrs with a fine file. Replace housing if bores are badly scored.

Check valve bores in housing. Replace housing if bores are badly scored.

Check valve seats (Fig. 6) for damage. Seats are not replaceable, but may be repaired using NJD150 valve seat repair kit. Use kit exactly as directed by the manufacturer.



1—Return Valve Seat
2—Pressure Valve Seat

Fig. 6-Valve Seats

Inspect valves for scoring or damage.

Check valve rollers for freedom, flat spots, pits or wear. Replace if necessary.

Check valve springs for correct compression length, and broken or damaged coils. The pressure valve springs should compress to 1.25 in. [31.75 mm] at 36 to 44 lbs. [16.3 to 19.9 kg] pressure. The return valve spring should compress to 1.25 in. [31.75 mm] at 19 to 23 lbs. [8.6 to 10.4 kg] pressure. The flow control valve spring should compress to 2.15 in. at 40.5 to 49.5 lbs. (18.3 to 22.5 kg)

Inspect detent assembly for damage or scoring. Be sure that pin will move freely in piston and guides. Check spring compression of 1.25 in [31.75 mm] at 19 to 23 lbs. [8.6 to 10.4 kg] pressure.

Check detent cam.

Inspect rocker and valve operating cams.

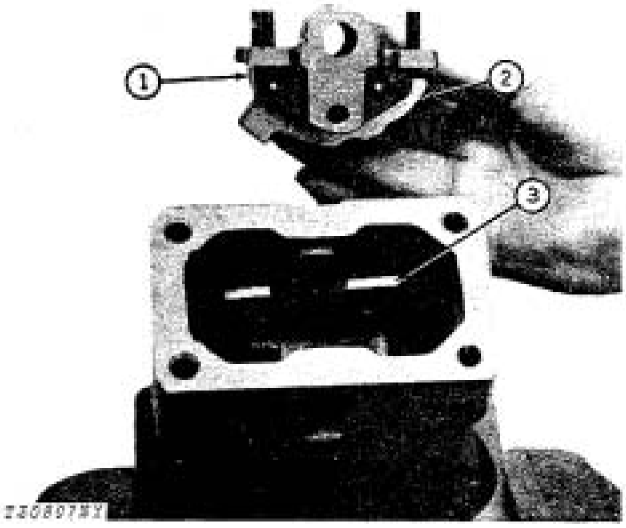
Dip new O-rings, backup washers, and parts in clean hydraulic oil being careful to keep all parts dirt free.

Insert detent follower. Be sure follower roller is located on rocker.

With the housing (13, Fig. 4) in position, the pointed ends of the valve operating cams (10 and 12) are installed toward the detent piston assembly. Note that the "float" cam (10) is shorter than the "regular" cam and is installed on the numbered side of the housing.

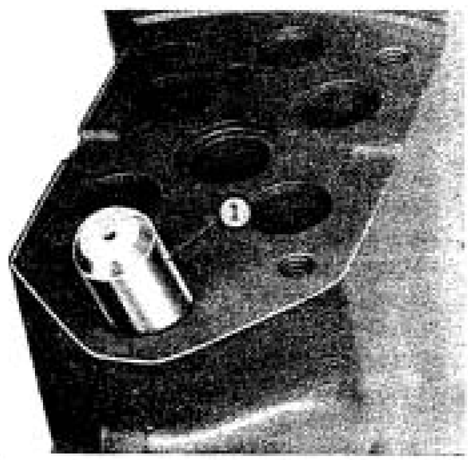
Install detent cam (Fig. 7) in rocker and rocker assembly in housing. Be sure that detent cam will locate on detent follower.

Install arm with shaft (44, Fig. 4) on housing.



1—Rocker
2—Detent Cam
3—Float Valve Operating Cam

Fig. 7-Detent Cam Installation



1—JDH-28 Driver

Fig. 8-Inner Detent Piston Guide Installation

Drive inner detent guide into detent bore with JDH-28 driver (Fig. 8).

Install detent pin with the short shank portion of pin in first. Install the detent piston with the shoulder facing outward. Install O-ring, back-up ring, spring, detent outer guide and snap ring.

ADJUSTMENT

The return and pressure valves are adjusted by setting specified distance between the selective control valve cams and the valve rollers while the selective control valve is in neutral position. This is to insure that the return valves open before the pressure valves during selective control valve operation.

A special adjusting cover, JDH-15C is used to make the valve adjustment. The cover valve locking screws hold the valves on their seats.

The adjusting procedure is as follows:

1. Replace the selective control valve cap and four valve guides with the adjusting cover. Make sure the four adjusting screws are not making contact with the valves.

2. With the valve housing in a vise and the open end up, remove the rubber keeper on the cam adjusting screws and loosen the screws.

3. Loosen the cam holding screws (11, Fig. 4) and let the cams rest on the valve rollers. Leave the holding screws slightly loose.

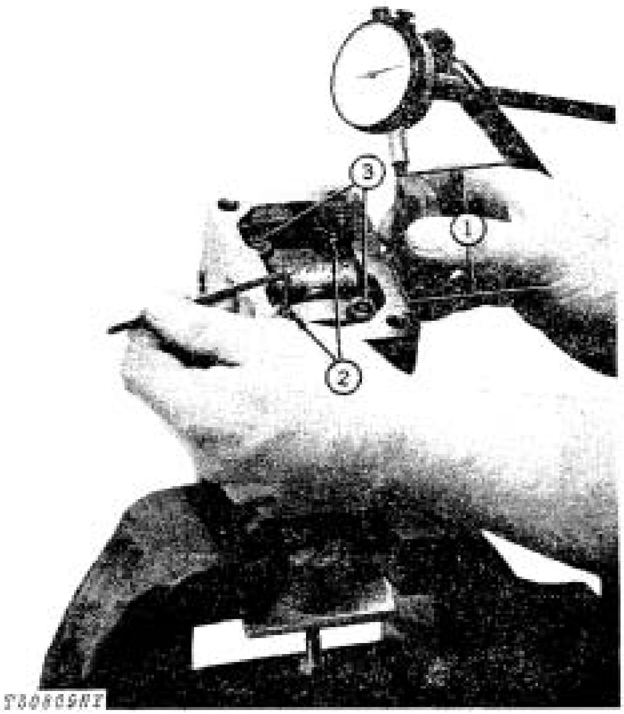
4. Turn in the two adjusting cover valve locking screws on the lever side of the housing to hold the pressure and return valves on that side on their seats. Rotate the rocker assembly to visually make sure that the cam is riding properly on the valve rollers. (The valves could possibly turn 90°, preventing cam contact.)

IMPORTANT: Do NOT use a wrench on any of the adjusting cover screws. Tighten with fingers only.

5. Level the rocker in relation to the housing edge. Gradually screw in the adjusting cover detent piston locking screw to force the detent piston follower to just touch the rocker. Move the rocker slightly until the follower is felt going into the neutral notch. Finger tighten the screw to hold the rocker in neutral.

6. With the rocker held in neutral, install a dial indicator (with minimum 0.140 in. [3.56 mm] travel) on the valve lever 2 in. [50.8 mm] from the center of the rocker shaft (Fig. 9). Zero the indicator at mid-point of its travel.

7. Turn in the two cam adjusting screws on the lever side of the housing evenly until they just touch the cam. Do not apply pressure. If screws appear uneven (Fig. 9), check the cam for tilt.



1—2 in. [50.8 mm]
2—Return Valve Adjustment
3—Pressure Valve Adjustment

Fig. 9-Valve Adjustment

8. Install rubber keepers and back out the cam adjusting screw over the return valve 1/8 turn. Back out the adjusting screw located over the pressure valve 1/4 turn.

9. Tighten cam holding screws and pry cam up against adjusting screws.

NOTE: Each time the cam adjusting screws are backed away from the cams, the cams must be pried up against the screws, without loosening the cam holding screws.

10. Rotate the rocker in both directions. As the cam touches the return valve roller the dial indicator should read 0.024 ± 0.016 in. [0.61 ± 0.41 mm]. As the cam touches the pressure valve roller in the other direction, the indicator should read 0.064 ± 0.016 in. [1.6 ± 0.41 mm]. Turn cam adjusting screws (Fig. 9) in to decrease or out to increase the distance to obtain these specifications.

11. Occasionally check the "zero" reading on the dial indicator as directed in steps 5 and 6.

12. Back out the adjusting cover valve locking screws on the lever side and turn in the valve locking screws on the opposite side to hold the other return and pressure valves on their seats. Zero the dial indicator.

13. Adjust the other return and pressure valves in the same manner as the first two were adjusted. The dial indicator should read as specified.

NOTE: Remember, pressure and return valves are diagonally opposite each other in the valve housing.

14. Recheck the zero reading and all four valve adjustments. Readjust if necessary.

15. Reinstall selective control valve cap and four valve guides. Tighten cap screws to 35 lb-ft [4.84 kg-m]. Do not remove valves unless necessary. Valves must be readjusted if the valves are removed and installed.

Install metering valve arm so that the notch in valve and the long portion of arm point in opposite directions.

INSTALLATION

Install selective control valve on unit.

Perform selective control valve test.

Group 55
Rockshaft System

GENERAL INFORMATION

The rockshaft with 3-point hitch will handle integral and semi-integral implements with three types of control: load, depth, and load-and-depth.

When the system is set for depth control (selector lever in "D" position) the position of the rockshaft is always in direct relation to the position of the control lever on the quadrant.

In either load control ("L") or load-and-depth control ("LD") operation, the rockshaft control valve receives signals from the 3-point hitch draft links. The draft links are connected directly to the load control shaft positioned through the bottom rear of the transmission case on tapered bushings. Variation of pull on the draft links deflects the load control shaft. This deflection is picked up by the load control arm and transmitted to the rockshaft valve linkage.

The lowering speed of the rockshaft and equipment is regulated by the rate-of-drop screw located on the top of the rockshaft housing in front of the tractor seat.

A relief valve in the rockshaft cylinder relieves thermal expansion of oil in the rockshaft assembly.

The 3-point hitch is basically a category 2 hitch but is adaptable to category 1 equipment by installing adapter bushings on the draft links and a pin and bushing in the center link.

Neutral

In Fig. 1 (26), the rockshaft is shown in neutral. The engine is running and the rockshaft control lever is stationary. Hydraulic supply oil entering through internal drilled passages (6) has pressurized the rockshaft up to the pressure valve (7).

Raising the Rockshaft (Depth Control)

For "depth control," the load selector lever (17) is moved to upper "D" position. This moves load selector link and roller (10) to the top of cam follower (11). The cam follower in turn rides against the rockshaft cam (12) which is attached to the rockshaft. The rockshaft cam closes the pressure valve (7) when the rockshaft is raised.

When the rockshaft control lever (18) is moved to the rear, the valve linkage moves the spool-type pressure valve (7) from valve seat (23), against spring and oil pressure behind damping sleeve (22). Small increments of rockshaft movement can be accomplished by moving the control lever just enough to "crack" the valve from its seat. Pressure oil flows past the pressure valve (7) into a passage connected with the rockshaft cylinder where it unseats check valve (20) and flows into the cylinder. As the oil enters the cylinder, it causes the piston rod and crank arm to rotate the rockshaft and lift arms upward.

As the rockshaft rotates, the rockshaft cam moves the cam follower (11), and load selector link and roller (10) rearward. This motion is transmitted through the valve linkage, closing the pressure valve (7) and completing the depth cycle. Full upward rockshaft movement is limited by contact of the rockshaft crank arm (24) against the rockshaft housing.

The pressure valve (7) does not close abruptly because of pressure differences between the front and rear of the damping sleeve (22). As pressure oil flows through orifice in the sleeve a gradual build-up occurs on the end of the sleeve, moving the control valve to the closed position. This controlled pressure build-up behind the sleeve results in smooth, precise rockshaft control.

The discharge valve (8) and the rockshaft check ball (20) trap oil in the rockshaft cylinder to keep the rockshaft from lowering when the tractor engine is shut off.

Lowering the Rockshaft (Depth Control)

To lower the rockshaft (27, Fig. 1), the control lever (18) is moved forward, opening the discharge valve (8), the distance determined by the control lever. As the discharge valve is opened, the weight of the implement on the lift link rotates the rockshaft and crank arm, moving the piston forward. Return oil under slight pressure moves out of the rockshaft cylinder past the discharge valve.

The rate of the lowering cycle is determined by the adjustment of throttle or rate-of-drop valve (9).

As the rockshaft rotates and the lift arms are lowered, the spring-loaded cam follower (11) moves rearward following the rockshaft cam. The valve linkage moves away from the discharge valve (8), closing the valve and completing the depth control lowering cycle.

Load Control

For load control, the selector lever (17) is moved to lower, "L" position. This moves load selector link and roller (10) to bottom of the cam follower (11). The rockshaft valve linkage now becomes independent of the rockshaft cam rotation. Linkage signals now come from the equipment acting on the draft links, load control shaft (16) and load control arm (15).

Moving the control lever forward repositions the valve linkage to open discharge valve (8) and lowers the rockshaft and implement to the desired implement working position.

NOTE: The position of the control lever in the quadrant predetermines the amount of draft load required to raise or lower the rockshaft, maintaining a constant load on the tractor.

As the draft load is applied to the draft links, the rockshaft will continue to lower until the load established by the control lever position is reached.

During this operation a signal is sent through the load control shaft (16) and load control arm (15) to the load selector link and roller (10). This moves the valve linkage to close the return valve, stopping the lowering cycle. The lowering cycle stops when the load, predetermined by the control lever, is reached; therefore, the pressure and discharge valves will remain closed until a signal is received that is more or less than the established load.

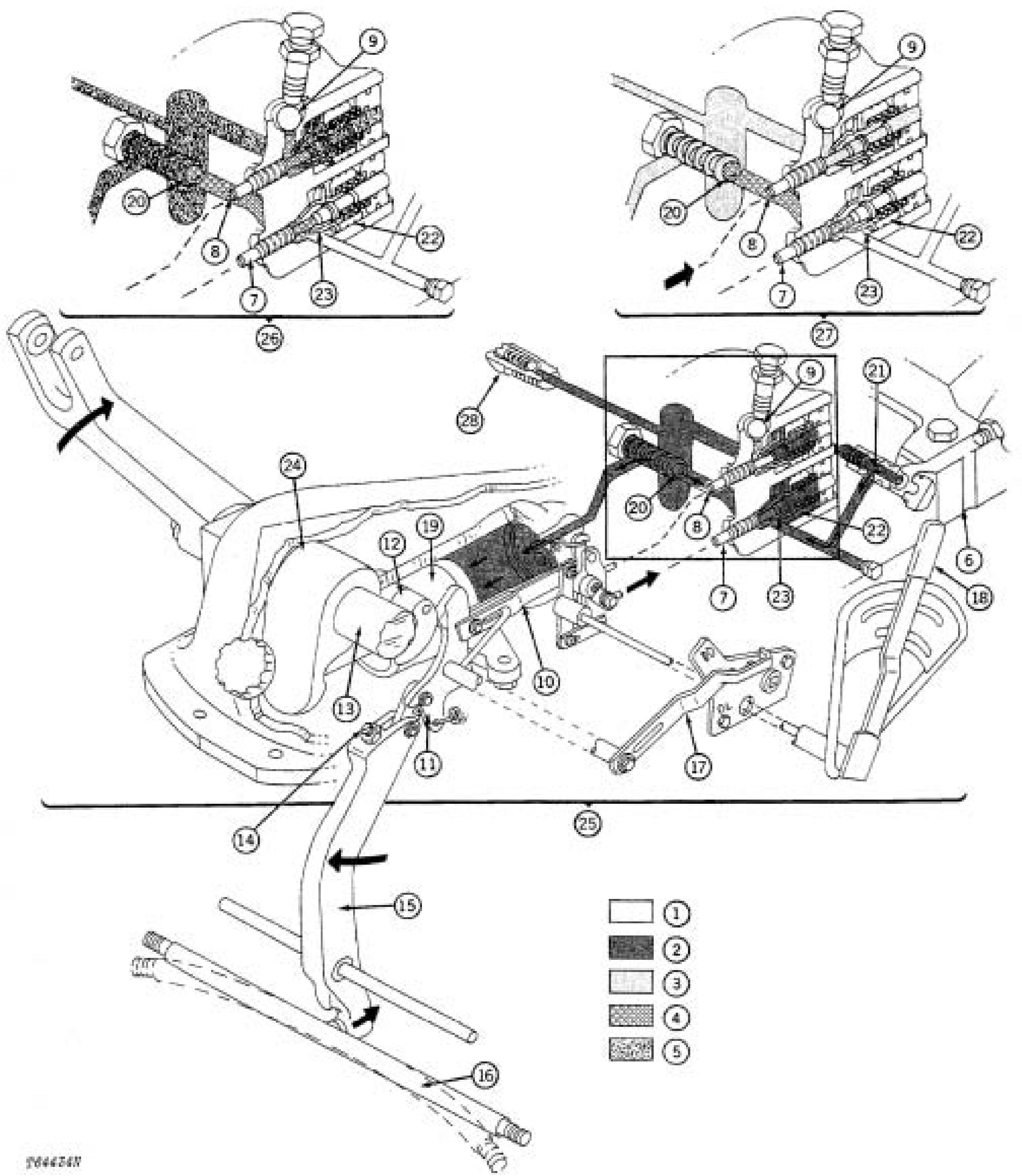
If the draft load increases (more than the predetermined load) the signal is picked up by the load selector link and roller, which is moved rearward to open pressure valve (7) and raise the rockshaft. As the rockshaft is rising and draft is decreasing, the deflection of the load control arm is lessened and the valve linkage moves forward to a neutral position, allowing the pressure valve to close.

If the draft load decreases, the draft signal will be less than required to keep the load at the predetermined amount (preset by control lever). Therefore, the load selector link and roller will be moved forward and will open the discharge valve to lower the rockshaft. The rockshaft will continue to lower until the predetermined load is reached, whereupon the valve linkage will be moved rearward to close the discharge valve.

Load-And-Depth Control

The load selector control lever (17, Fig. 1) is moved to the center, "LD" position. This moves the load selector link and roller (10) to the center of the cam follower (11). The percentage of the draft signal transmitted to the rockshaft control valves is less, compared to load control operation. The rockshaft cam (12) is now able to transmit signals to the control valves as previously explained under "depth control."

The load-and-depth position is the best position for most operations requiring some load-compensated depth control.



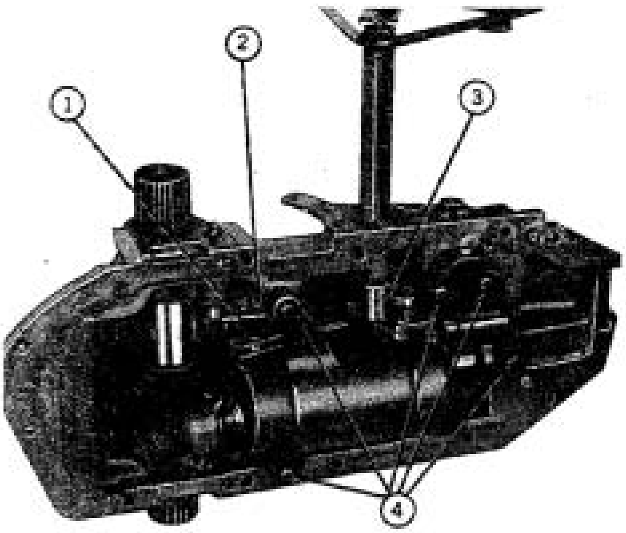
1—Pressure Oil
2—Working Pressure Oil
3—Discharge Pressure Oil
4—Pressure Free Oil
5—Trapped
6—Inlet from Pump
7—Pressure Valve
8—Discharge Valve
9—Throttle Valve (Rate of Drop)
10—Selector Link and Roller
11—Cam Follower
12—Rockshaft Cam
13—Rockshaft
14—Cam Follower Adjusting Screw
15—Load Control Arm
16—Load Control Shaft
17—Load Selector Lever
18—Control Lever
19—Piston
20—Check Ball
21—Flow Control Valve
22—Control Valve Damping Sleeve
23—Control Valve Seat
24—Rockshaft Crank Arm
25—Load and Depth Control Cycle
26—Neutral Cycle
27—Lower Cycle
28—Thermal Relief Valve

Fig. 1-Rockshaft System

REMOVAL

Disconnect rockshaft from transmission, place selector lever in the "L" position and remove rockshaft from transmission.

REPAIR



1—Selector Arm
2—Valve Spring
3—Spring Pin
4—Attaching Cap Screws

Fig. 2-Removing Rockshaft Cylinder and Valve Parts

Remove rockshaft arms from splined rockshaft.

Remove rockshaft control lever from control arm.

Remove cap screws fastening rockshaft control lever quadrant to rockshaft housing.

Separate load selector lever from shaft.

Turn rockshaft assembly over to expose cylinder and valve housing.

Drive out spring pin fastening rockshaft control arm and shaft to pivot block (Fig. 2).

Remove remote cylinder adapter from left side of rockshaft housing. Unhook valve spring from pin in rockshaft housing.

Remove cap screw at outside front of housing. Remove remaining cap screws and lift away cylinder and valve assembly. As assembly is lifted from housing, work load selector arm free of slotted link. Piston in cylinder will pull away from piston rod. Be careful not to lose throttle valve ball as it will fall free.

With cylinder and valve housing and linkage separated from rockshaft housing, valve assembly may be completely disassembled.

Slide rockshaft piston from cylinder.

NOTE: If piston is difficult to remove, take out plug at rear of cylinder and push out piston.

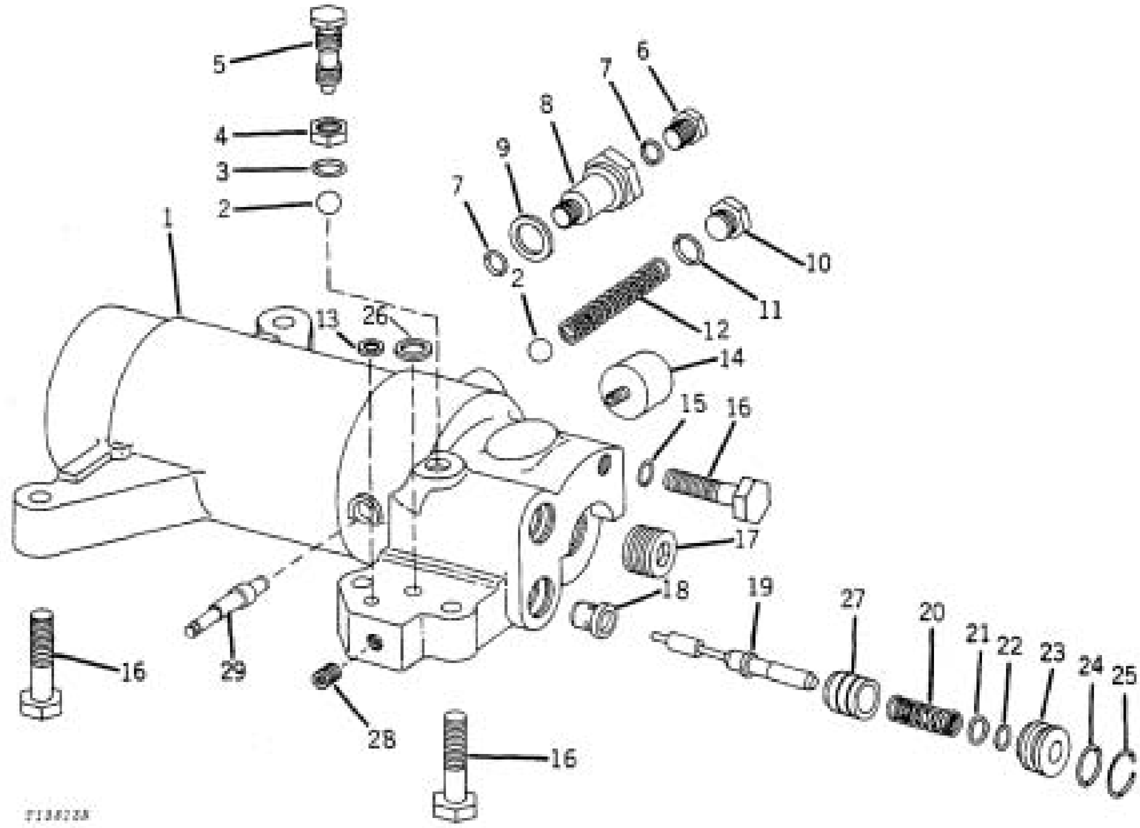
Remove check valve hex. plug and slide spring and check ball from housing.

Remove thermal relief valve.

Remove snap rings retaining pressure and discharge valve plugs. Slide plugs, springs, sleeves, valves, and valve seats from bores in housing. Keep pressure and discharge valve assemblies separate.

Check rockshaft control valves (19) for wear or damage, especially the seating area of each valve. Leakage in this area could cause rockshaft settling if wear occurred in discharge valve, or creeping upward if wear occurred in a pressure valve. Examine valve seats (18) and control valve sleeves (27) for wear or scoring.

Examine rockshaft check ball (2) for damage or wear. Check ball wear will result in leakage around the ball which may cause rockshaft settling when engine is shut-off.



1—Cylinder and Valve Housing
2—Steel Ball (2 used)
3—O-Ring Packing
4—Hex. Nut
5—Rate-of-Drop Screw
6—Plug
7—O-Ring Packing (2 used)
8—Remote Cylinder Outlet Adapter
9—Gasket
10—Plug
11—O-Ring Packing
12—Spring
13—Gasket
14—Thermal Relief Valve
15—O-Ring Packing
16—Cap Screw (5 used)
17—Pipe Plug
18—Valve Seat (2 used)
19—Control Valve (2 used)
20—Control Valve Spring (2 used)
21—O-Ring Packing (2 used)
22—Back-up Ring (2 used)
23—Control Valve Plug (2 used)
24—O-Ring Packing (2 used)
25—Snap Ring (2 used)
26—Packing
27—Control Valve Sleeve (2 used)
28—Plug Pipe
29—Pivot Pin

Fig. 3-Rockshaft Cylinder and Valve Housing

Replace all packings around plugs in cylinder and valve housing. Be sure to replace packing in pressure oil inlet bore to cylinder and valve housing.

Remove all linkage from pivot pin on cylinder and valve housing.

Examine control linkage parts for worn or bent condition.

Check rockshaft control valve adjusting cam (10) for wear or damage. Wear on this cam could cause difficult adjustment for rockshaft control lever neutral range.

Check all rollers for flat spots or other damage.

Remove rockshaft cam from shaft and remove rockshaft from rockshaft housing.

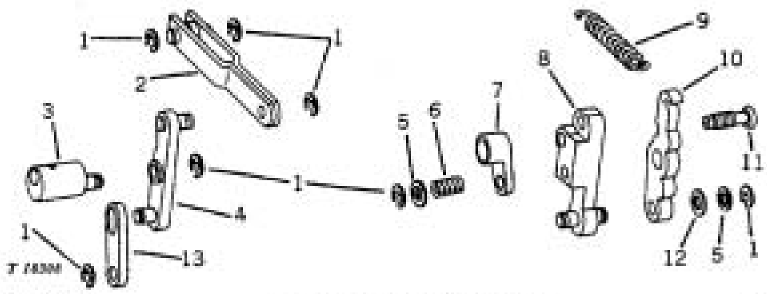
Pull rockshaft from housing, allowing rockshaft crank arm to slide off rockshaft splines. Bushings, O-rings, and retainers will come with shaft.

Separate piston rod from rockshaft crank arm.

Examine rockshaft (4) for cracked splines or other damage.

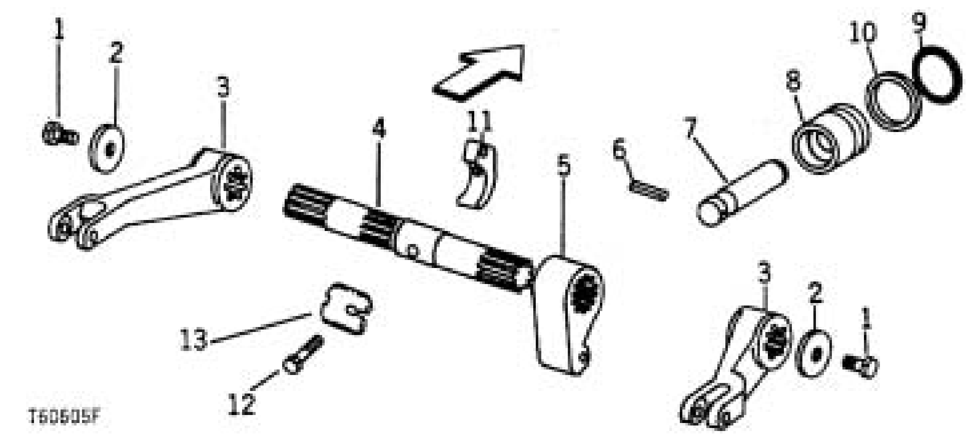
Check lift arm (3) for any apparent damage.

Examine rockshaft crank arm (5) and piston rod (7) for damage.



1—Retaining Ring (7used)
2—Load Selector Link with Roller
3—Pivot Block with Pin
4—Link with Pins
5—Plain Washer (2 used)
6—Spring
7—Special Nut
8—Link with Pin
9—Spring
10—Valve Adjusting Cam
11—Special Adjusting Screw
12—Special Bowed Washer
13—Link

Fig. 4-Rockshaft Linkage



1—Cap Screw (2 used)
2—Retainer (2 used)
3—Lift Arm (2 used)
4—Rockshaft
5—Crank Arm
6—Spring Pin
7—Piston Rod
8—Piston
9—O-Ring Packing
10—Back-Up Ring
11—Rockshaft Cam
12—Cap Screw
13—Retainer

Fig. 5-Rockshaft and Lift Arms

Remove O-ring packing (9) and back-up ring (10) from piston and discard. Examine piston for scoring or excessive wear.

Install new back-up ring and retainer in piston groove.

Inspect housing (38) for cracks or other damage.

Inspect bushings (6) in rockshaft bores.

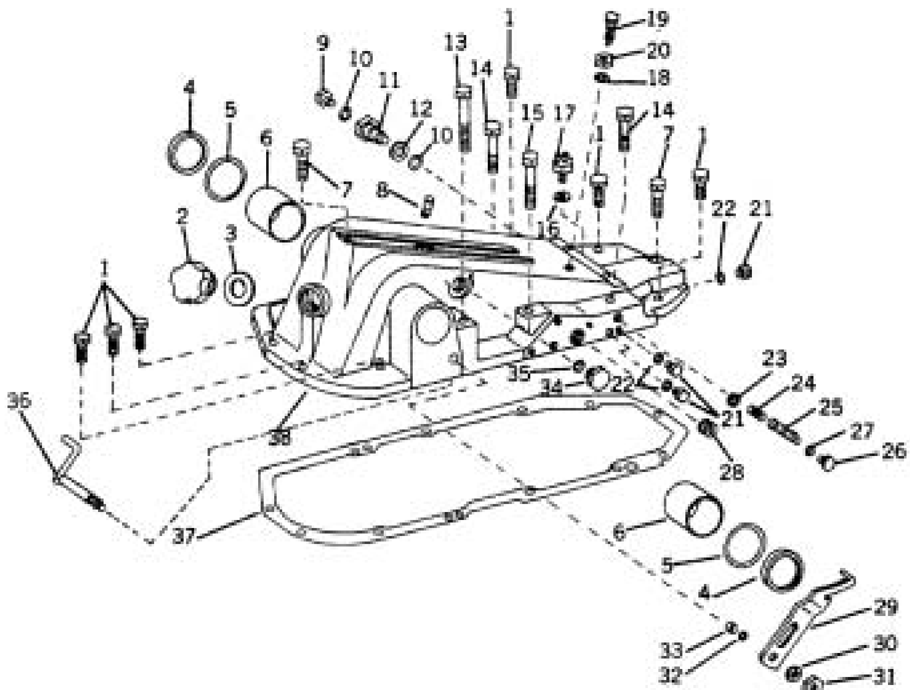
Inspect O-ring packings (5) in rockshaft bore in housing. Check retainer (4) for bent or worn condition.

Examine flow control valve (25) for damage.

Check valve spring (24) for free length of 3.687 in. [93.65 mm], and test length is 2.562 in. [65.07 mm] with 12.5 to 15.5 lbs. [5.67 to 7.03 kg].

Check load selector arm (36) for bent condition.

Examine bushing (33) in load selector bore and replace if worn or damaged. Press in until unchamfered end is flush with outside of housing.



1—Cap Screw (9 used)
2—Oil Filler Cap
3—Packing
4—Retainer (2 used)
5—O-Ring Packing (2 used)
6—Bushing (2 used)
7—Cap Screw (4 used)
8—Special Pin
9—Plug
10—O-Ring Packing (2 used)
11—Remote Cylinder Outlet Adapter
12—Gasket
13—Cap Screw
14—Cap Screw (2 used)
15—Cap Screw
16—Special Aluminum Washer (2 used)
17—Starter Safety Switch
18—O-Ring Packing
19—Rate-of-Drop Screw
20—Hex. Nut
21—Plug (2 used)
22—O-Ring Packing (2 used)
23—Plain Washer
24—Spring
25—Flow Control Valve
26—Plug
27—O-Ring Packing
28—Pipe Plug
29—Load Selector Lever
30—Washer
31—Hex. Jam Nut
32—O-Ring Packing
33—Selector Arm Shaft Bushings
34—Plug
35—O-Ring Packing
36—Load Selector Arm
37—Gasket
38—Rockshaft Housing

Fig. 6-Rockshaft Housing

Examine rockshaft control lever and quadrant using Fig. 7 as a guide.

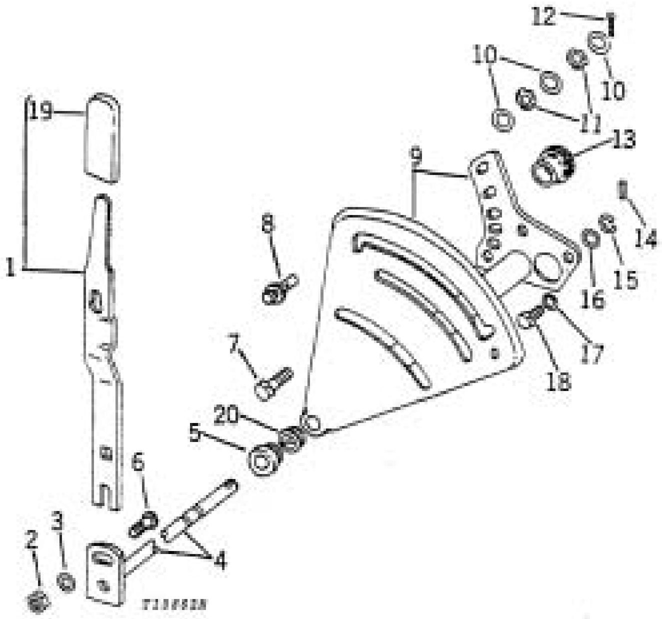
Replace any damaged or worn parts.

Check rockshaft friction spring washers for wear or flattened condition.

Rockshaft Cylinder and Valve Housing Assembly (Fig. 3)

Slide valve seats (small end first) into pressure and discharge valve bores. Install valves (smaller diameter first) in seats. Place sleeve (chamfered end first) behind valves and install valve springs.

With packing on outside of valve plugs and packing and back-up ring inside, secure plugs in valve bores with retaining rings. Use care when inserting valve in valve plug.



1—Control Lever
2—Hex. Nut
3—Plain Washer
4—Control Lever Arm
5—Adapter
6—Round Head Bolt
7—Special Screw
8—Friction Pin
9—Quadrant Assembly
10—Plain Washer (3 used)
11—Special Spring Washer (2 used)
12—Cotter Pin
13—Knob
14—Spring Pin
15—Retaining Ring
16—O-Ring Packing
17—Lock Washer (3 used)
18—Cap Screw (3 used)
19—Grip
20—Bushing

Fig. 7-Rockshaft Control Lever and Quadrant

Install back-up ring and O-ring on piston.

Coat piston and cylinder with JD303 Special-Purpose Oil and slide piston into cylinder.

Install check ball, spring, and plug in cylinder and valve housing.

Rockshaft Linkage (Fig. 4)

Install valve operating linkage to pivot pin on housing. Check to see that linkage operates freely without binding.

Rockshaft and Lift Arms (Fig. 5)

Slide rockshaft into rockshaft crossbores, allowing crank arm to slide on shaft.

Crank arm and rockshaft splines match in only one way, insuring proper indexing.

Install rockshaft bushings (they should be free in rockshaft bores). Place O-ring packings over rockshaft and push into housing. Grease packings before installation. Install retainers (cupped side to outside) on rockshaft and push into rockshaft bores.

Install cam on rockshaft and connect rockshaft piston rod to crank arm.

Grease rounded pivot end of piston rod before assembly in crank arm.

Installing Cylinder and Valve Assembly

Place gasket (13, Fig. 3) and packing (26) on flange of valve housing. Position O-ring (15) in front attaching hole of valve housing. Install cylinder and valve assembly in rockshaft housing. At the same time, position load selector arm in load selector link and place piston rod in piston.

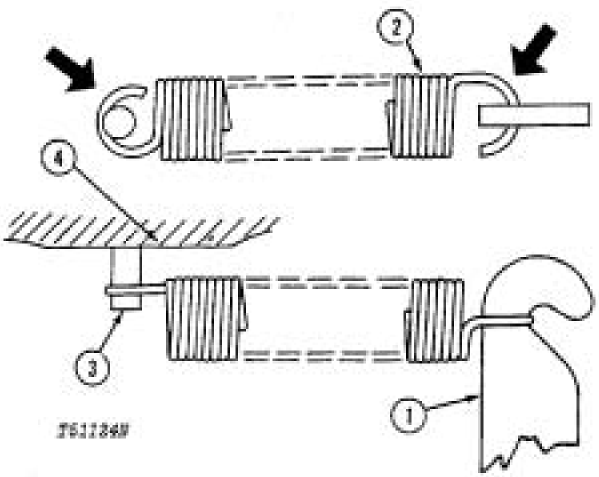
Install front attaching cap screw and tighten securely (Fig. 2).

Front cap screw must be tightened first, before bottom cap screws, to draw cylinder and valve housing into correct position in rockshaft housing.

Install remainder of attaching hardware.

Hook valve linkage spring (2, Fig. 8) to dowel (3) in rockshaft housing (4) and valve adjusting cam (1).

IMPORTANT: Failure to install spring as shown will result in a broken spring or have a tendency of falling off of dowel.



1—Valve Adjusting Cam
2—Valve Linkage Spring
3—Dowel
4—Rockshaft Housing

Fig. 8-Correct Installation of Valve Linkage Spring

Place throttle valve ball in bore and install throttle valve adjusting screw.

Install rockshaft control shaft in housing and pin to pivot block with spring pin.

Install rockshaft lift arms on shaft. Tighten retaining cap screws.

Rockshaft arms do not have to be indexed to rockshaft as the splines permit installation in only the correct position.

Install control lever to control lever arm.

Connect load selector lever to load selector arm shaft.

Install remote cylinder adapter in bore in left side of rockshaft housing.

Move selector and control levers through their full range to check for binding parts.

INSTALLATION

Place rockshaft selector lever in "L" position and install rockshaft housing.

LOAD CONTROL MECHANISM

Removal

Remove rockshaft assembly, 3-point hitch, and left axle housing.

Remove load control arm pivot shaft and lift load control arm from differential compartment of transmission case.

Remove retainer rings from one end of load control shaft and slip retainer bushing from shaft. Drive load control shaft from transmission case using a suitable driver.

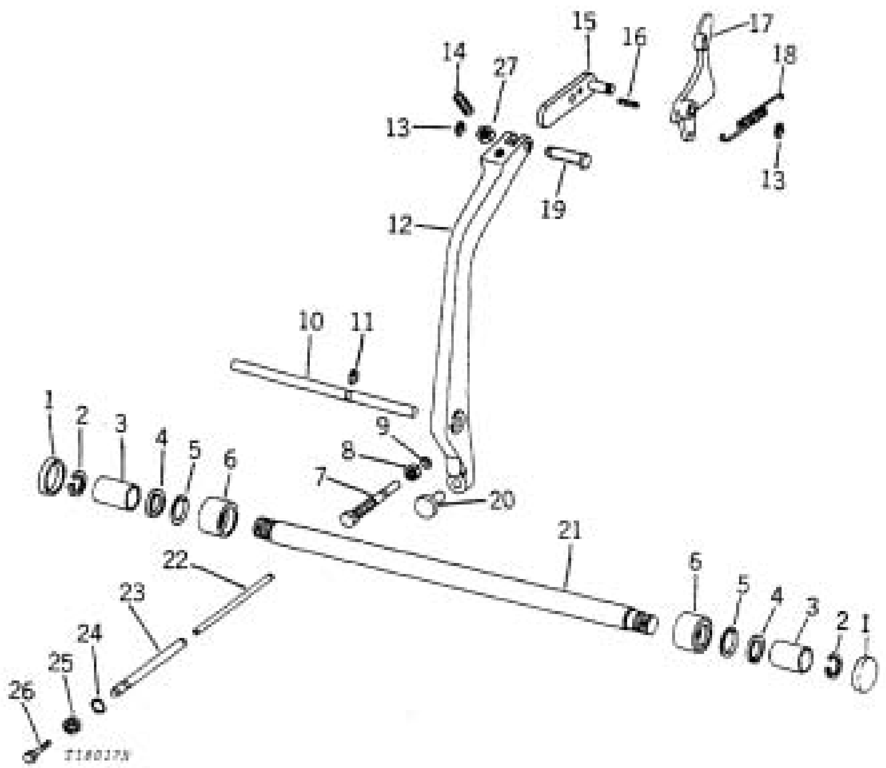
Remove load control arm negative stop adjusting screw from transmission case. (This screw is accessible from recess in right rear of transmission case.)

Repair

Inspect bushing (6, Fig. 6) in transmission case for wear or damage. If bushings require replacement, drive old bushings from transmission case. (Drive bushing out by inserting driver through opposite bushing.)

Using a suitable driver, drive new bushings, with new sealing ring (4, Fig. 9) and new O-ring packing (5), in transmission case (chamfer to the inside) (Fig. 10). Use care not to peen edges of new bushing.

Inspect load control arm (12, Fig. 9) for wear or damage. Check special pin (20) for rough spots in area where load control shaft makes contact. Examine load control arm extension (15) for damage. Smooth off any rough spots.



1—Plug (Without Rockshaft) (2 used)
2—Retaining Ring (2 used)
3—Load Control Shaft Retaining Bushing (2 used)
4—Sealing Ring (2 used)
5—O-Ring Packing (2 used)
6—Bushing (2 used)
7—Negative Stop Screw (Without Dual Independent PTO)
8—Hex. Jam Nut (2 used) (Without Dual Independent PTO)
9—O-Ring Packing (Without Dual Independent PTO)
10—Control Arm Pivot Shaft
11—Snap Ring
12—Load Control Arm
13—Retaining Ring (2 used)
14—Set Screw
15—Load Control Arm Extension
16—Spring Pin
17—Cam Follower
18—Cam Follower Spring
19—Headed Pin
20—Special Pin
21—Load Control Shaft
22—Front Rod (With Dual Independent PTO)
23—Rear Rod (With Dual Independent PTO)
24—Packing (With Dual Independent PTO)
25—Jam Nut (With Dual Independent PTO)
26—Cap Screw (With Dual Independent PTO)
27—Jam Nut (With Dual Independent PTO)

Fig. 9-Load Control Linkage

Examine load control shaft (21, Fig. 9) for damage. Check shaft for bent condition.

Replace O-ring packing (5) and sealing ring (4).

Examine retainer bushing (3, Fig. 9) for wear.

Inspect load control arm negative stop screw (7) for wear, especially on end contacting load control arm. Replace O-ring packing (9) on screw.

Installation

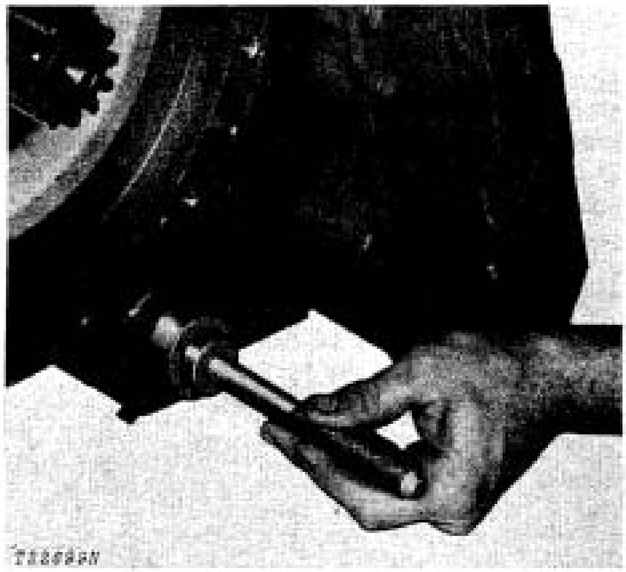


Fig. 10-Installing Load Control Shaft Bushings

With tapered bushings installed, carefully slip load control shaft into load control shaft bores in transmission case. *Place a thin sleeve over end of shaft to prevent damage to seals.* Coat shaft with JD303 Special-Purpose Oil before installation.

Place retainer bushings on ends of load control shaft protruding from transmission case and secure with retaining rings.

Place load control arm with extension and cam follower in rear compartment of transmission case and install arm pivot shaft. Install load control arm spring.

Install load control arm negative stop screw in transmission case. Coat O-ring on screw with JD303 Special-Purpose Oil before installation and use caution so as not to cut packing when installing it.

Leave screw backed out slightly until final adjustment is made.

ADJUSTMENTS

Before making adjustments on the rockshaft, check hydraulic oil level. Run tractor to warm hydraulic oil to operating temperature. Check to see that there are no leaks.

Make the adjustments in the exact order given.

(1) Throttle (rate-of-drop) valve adjustment
(2) Load control arm negative stop adjustment
(3) Rockshaft control lever neutral range adjustment
(4) Control lever positioning adjustment
(5) Load control adjustment

(1) Throttle Valve

The rate of rockshaft and implement drop is controlled by the valve screw located just forward of the tractor seat.

Turn throttle valve counterclockwise to increase or clockwise to decrease rate of drop. Secure with lock nut.

(2) Negative Stop Screw

With lock nut loose, turn negative stop screw (7, Fig. 9) in until it just contacts the load control arm. Back screw off 1/4 turn on units without dual independent PTO or 1.3 turns on units with dual independent PTO.

NOTE: Contact of screw with arm can be felt more easily if a screwdriver is held against upper end of arm, through housing oil filler hole.

IMPORTANT: If negative stop screw is not adjusted correctly, it may affect the remaining adjustments.

(3) Rockshaft Control Lever Neutral Range

With engine running and load selector lever in "D" position, slowly move the control lever to lower and raise the rockshaft. On the upper quadrant bead, note the distance that the lever moves as the rockshaft starts to raise and starts to lower. The distance should be 1/8 to 3/16 inch (3 to 5 mm) for proper valve clearance.

Turn control valve adjusting screw counterclockwise to decrease the distance or clockwise to increase the distance (1/4 turn varies the distance by 1/8 inch [3 mm]).

(4) Rockshaft Control Lever Position

With engine running and load selector lever in "D" position, completely lower the rockshaft. Loosen the control lever adjusting hex. nut (2, Fig. 7) and move lever to rear until lever pin is 5/16 inch (8 mm) from bottom end of slot.

Rotate control lever arm all the way to the front. Then slowly rotate it to the rear until the rockshaft starts to raise. Secure the lever adjusting nut.

Completely raise and lower rockshaft. Lever should be 5/16 inch (8 mm) from bottom end of slot when fully lowered and have minimum clearance between lever pin and upper end of slot when fully raised.

(5) Rockshaft Load Control

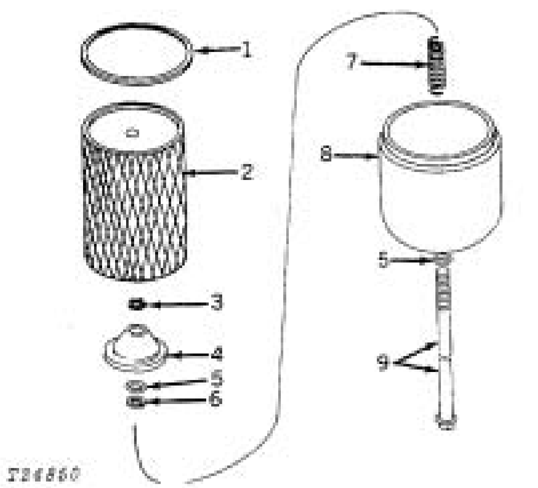
With engine running and load selector lever in "L" position, completely lower the rockshaft, then move lever to the rear. If rockshaft starts to raise before lever is 3-5/8 inches (92 mm) from upper end of slot, adjust the cam follower adjusting screw.

With the lever at 3-5/8 inches (92 mm) from upper end of slot, turn cam adjusting screw counterclockwise until rockshaft is completely lowered. Then slowly turn screw clockwise until rockshaft starts to rise. Tighten jam nut on adjusting screw.

Group 60
MISCELLANEOUS HYDRAULIC COMPONENTS

TRANSMISSION FILTER ASSEMBLY

General Information



1—O-Ring
2—Element
3—Retaining Ring
4—Retainer
5—O-Ring (2 used)
6—Washer
7—Spring
8—Cover
9—Cap Screw

Fig. 1-Transmission-Hydraulic Filter

The transmission-hydraulic system has a full-flow filter which contains a disposable micronic paper element.

The differential pressure operated oil filter relief valve is incorporated into the filter system to allow oil on the outlet side of the transmission oil pump to return to the transmission case should the filter become clogged or when the oil is heavy during the warm-up period.

Removal

Filter

Remove filter cover, element, and O-ring packing.

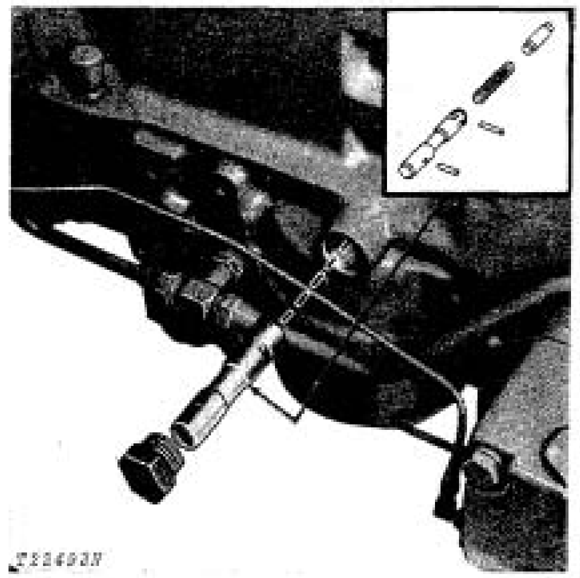


Fig. 2-Oil Filter Relief Valve

Relief Valve

Remove oil filter relief valve plug and slide sleeve with spring and valve from bore in transmission case.

Remove valve from sleeve by driving out spring pin. Slide spring from sleeve.

Repair

Relief Valve

Test relief valve spring tension. The spring must have a free length of 2.56 in. [65.02 mm] and a length of 1.31 in. [33.27 mm] when compressed with 9.5 to 10.5 pounds [4.3 to 4.8 kg].

Installation

Filter

Install new packing in groove in transmission case. Be sure packing is fully seated.

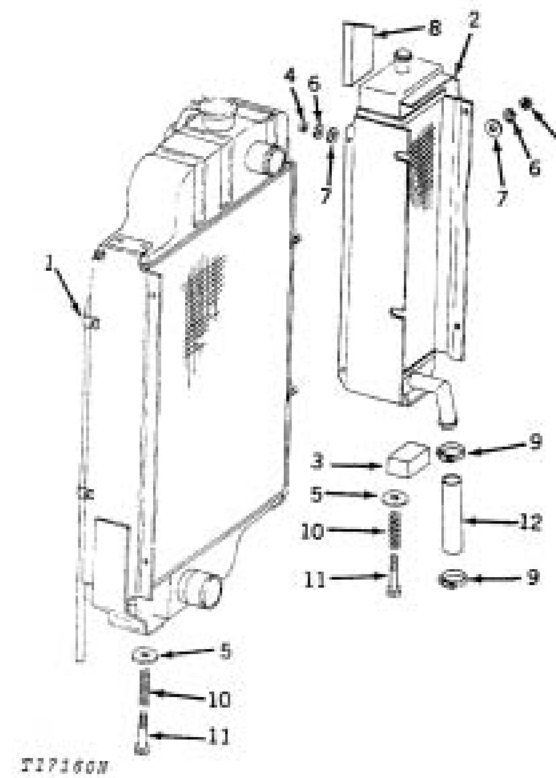
Install new element and filter cover. Tighten securely, but do not overtighten.

Relief Valve

Install sleeve in transmission case and use a new O-ring on plug.

OIL COOLER

General Information



1—Radiator
2—Oil Cooler
3—Baffle (2 used)
4—Nut (4 used)
5—Rubber Washer (2 used)
6—Lock Washer (4 used)
7—Washer (4 used)
8—Baffle
9—Clamp (2 used)
10—Spring (2 used)
11—Cap Screw (2 used)
12—Hose

Fig. 3-Oil Cooler

The oil cooler prevents excessive oil temperatures generated by the hydraulic system and reverser unit (if used).

Removal

Clean area around hose connections before removing the oil cooler. Remove oil cooler being careful not to damage the radiator or oil cooler fins.

Repair

FOS

Clean oil cooler thoroughly as described for radiators in FOS Manual, "ENGINES".

Installation

Replace hoses showing any deterioration. Be sure hose connections are clean before installing hoses.

AUXILIARY RESERVOIR

General Information

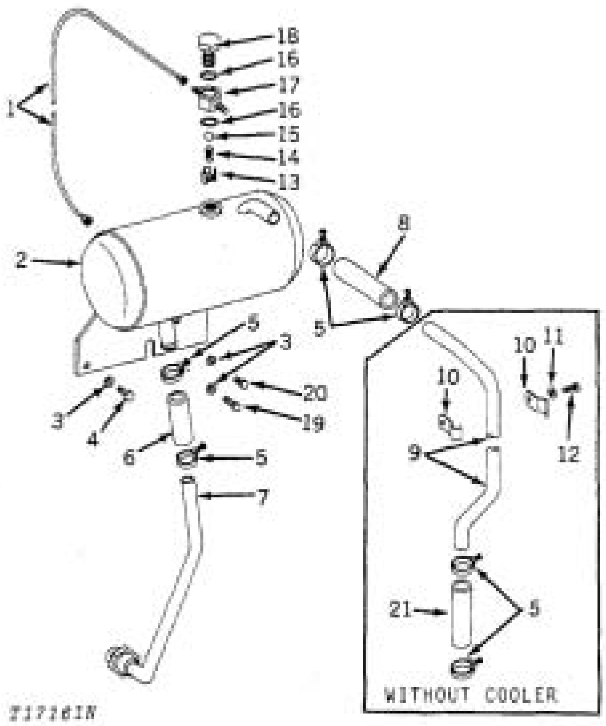
The auxiliary reservoir stores oil for use whenever the transmission oil pump is unable to meet the demands of the main hydraulic pump.

Removal

Reservoir check valve ball and spring will remove with special adapter on top of reservoir. Use care not to dislodge check valve assembly when withdrawing screw as it may fall into reservoir.

Repair

Once reservoir is removed, clean and thoroughly flush reservoir, and check for leaks or broken seams.



1—Drain Line
2—Reservoir
3—Lock Washer (3 used)
4—Cap Screw
5—Clamp (5 used)
6—Hose
7—Oil Line
8—Hose
9—Tube
10—Clamp (4 used)
11—Washer (2 used)
12—Drive Screws (2 used)
13—Guide
14—Spring
15—Steel Ball
16—O-Ring (2 used)
17—Adapter
18—Plug
19—Cap Screw
20—Cap Screw
21—Hose

Fig. 4-Auxiliary Reservoir

TRANSMISSION PUMP RELIEF VALVE

General Information

A relief valve is incorporated in the outlet circuit of the transmission oil pump. Located on the right side of the clutch housing, the relief valve dumps oil to the reservoir when pressure reaches a specified pressure in the drilled passageway connected to the main hydraulic pump inlet line.

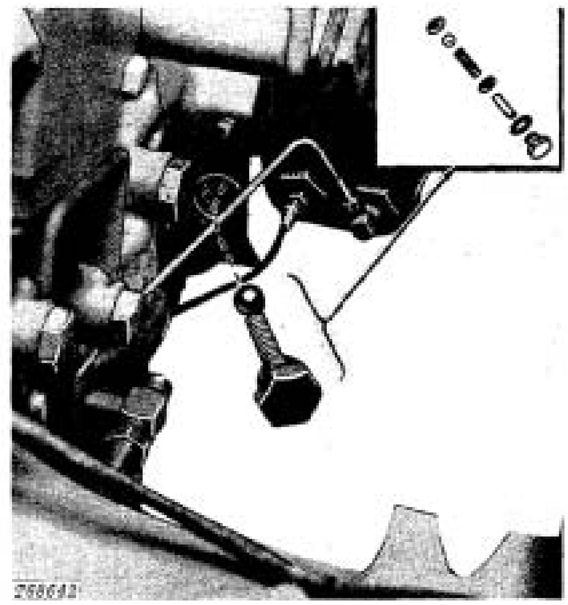


Fig. 5-Oil Pump Relief Valve

Removal

Remove the relief valve plug with pin and allow the relief valve spring and ball to slide from relief valve bore in clutch housing.

Repair

The relief valve seat is pressed into position in the relief valve bore in clutch housing. If seat is damaged and requires replacement, pry seat from bore and drive in new seat (chamfered end first).

Examine relief valve pin for damage or wear. Press pin to bottom of bore in plug.

Check valve spring for a free length of 1.87 in. [47.50 mm] and a test length of 1.12 in. [28.45 mm] with 30.5 to 37.5 pounds [13.8 to 17.0 kg].

Installation

Install assembly in place and use new O-ring on plug.

INLET LINE CHECK VALVE (Units Without Reverser)

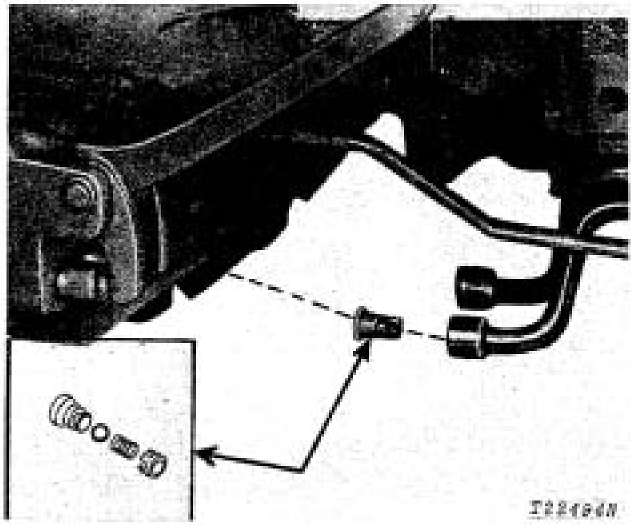


Fig. 6-Inlet Line Check Valve

A spring-loaded check valve is placed in the inlet line to the main pump at the point where the line connects to the clutch housing. Whenever the transmission oil pump is not functioning, this check valve keeps oil from draining out of the main pump and inlet line back to the transmission oil pump. This insures a ready supply of oil for the main hydraulic pump upon demand under most operating conditions.

Removal

Remove the oil line retainer from clutch housing and free line. Disconnect line from main hydraulic pump and move forward. Pull check valve retainer, spring, ball and seat from line.

Repair

Inspect check valve seat for wear or damage.

Check valve spring for a free length of 0.5 in. [12.7 mm] and a test length of 0.3 in. [7.6 mm] with 5 to 6 oz. [141.7 to 170.1 g].

Installation

To facilitate installation, place the oil line retainer over the lines before plugging it into the clutch housing.

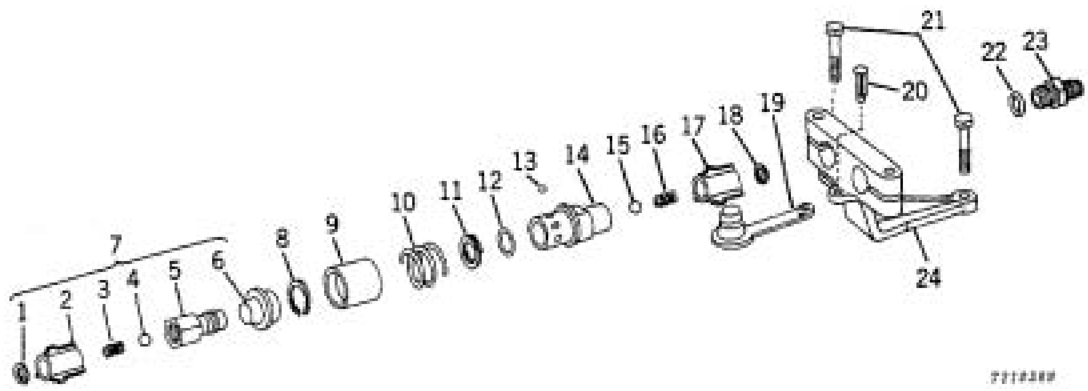
DISCONNECT COUPLERS

General Information

Refer to machine operator's manual for use of the Quick Disconnect Couplers and the FOS Manual—HYDRAULICS for theory of operation.

Removal

Clean area around the quick disconnect couplers. Remove and cap lines. Remove couplers from the unit.



1—Snap Ring (2 used)
2—Guide (2 used)
3—Spring (2 used)
4—Ball (2 used)
5—Plug (2 used)
6—Dust Cover (2 used)
7—Coupler Plug
8—Snap Ring (2 used)
9—Sleeve (2 used)
10—Spring (2 used)
11—Backup Ring (2 used)
12—O-Ring (2 used)
13—Ball (12 used)
14—Receptacle (2 used)
15—Ball (2 used)
16—Spring (2 used)
17—Guide (2 used)
18—Snap Ring (2 used)
19—Dust Cover (2 used)
20—Drive Stud
21—Cap Screw (2 used)
22—O-Ring (2 used)
23—Special Connector (2 used)
24—Bracket

Fig. 7-Disconnect Coupler

Refer to Fig. 7 for disassembly and assembly of the couplers.

Check spring (10) for a free length of 1.03 in. [26.2 mm] and a test length of 0.40 in. [10.2 mm] with 14 ± 1.4 pounds [6.4 ± 0.6 kg].

Inspect all parts of the assembly for wear or damage.

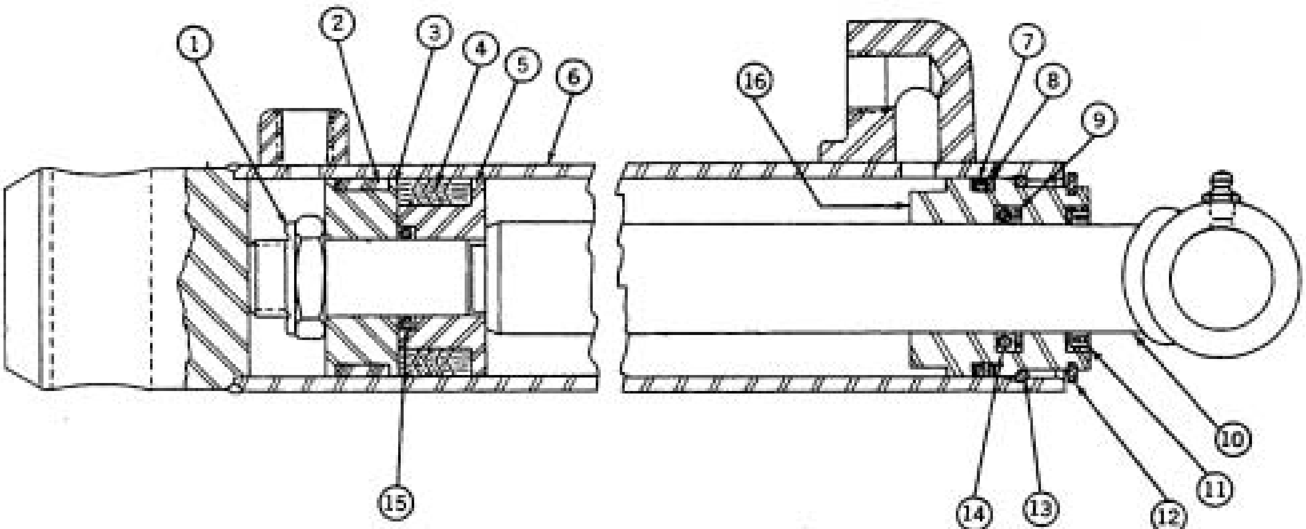
Assemble the coupler (Fig. 7).

Installation

Install coupler on unit and connect lines.

Group 65
HYDRAULIC CYLINDERS

GENERAL INFORMATION



1—Stop Nut
2—Wear Ring
3—Piston Retainer
4—V-Packing
5—Piston
6—Barrel
7—O-Ring
8—Back-up Washer
9—Back-up Washer
10—Wiper Seal
11—Wiper Seal
12—Snap Ring
13—Snap Ring
14—O-Ring
15—O-Ring
16—Rod Guide

Fig. 1-Cutaway View of Bucket Cylinder

The hydraulic cylinders used for loader functions are of the double acting type with V-packings. Piston rods are heat treated, chrome plated and polished.

Replaceable non-metallic wear rings are used on the piston retainers to prevent scoring of the cylinder barrels.

FOS — See "Hydraulic Cylinders" in FOS Manual - "HYDRAULICS" for additional description and theory of operation.

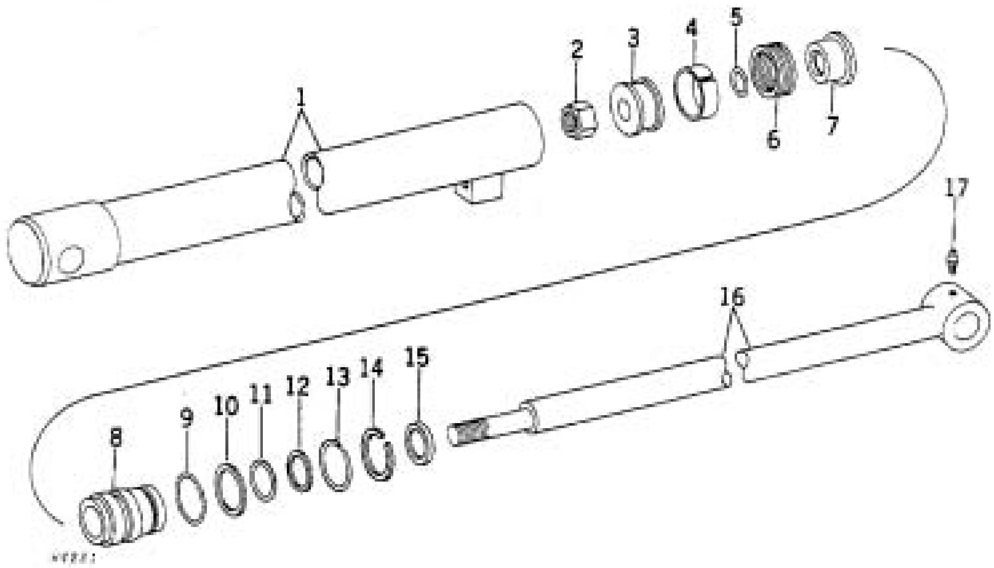
LOADER BUCKET CYLINDERS

Removal

Operate control valve lever until all hydraulic pressure is relieved.

Remove cylinders and cap all openings to prevent dirt entry.

If cylinder packings have failed, some fragments of the deteriorated parts may have entered the system. Completely drain the system and replace the filters.



1—Barrel	6—Packing	12—Backup Washer
2—Lock Nut	7—Piston	13—Snap Ring
3—Piston	8—Rod Guide	14—Snap Ring
4—Wear Ring	9—O-Ring	15—Wiper Seal
5—O-Ring	10—Backup Washer	16—Piston Rod
	11—O-Ring	17—Grease Fitting

Fig. 2-Bucket Cylinder

Repair

Clamp the cylinder in a vise to prevent it from turning.

Remove rod guide and pull piston assembly from barrel.

Clamp the cylinder rod end in a vise, using care to prevent damage to the piston rod. Remove nut from end of rod. Slide parts from rod.

Wash all parts thoroughly with diesel fuel and inspect as follows:

1. Check barrel, rod guide, and rod for scoring. Check O-rings for surface damage.

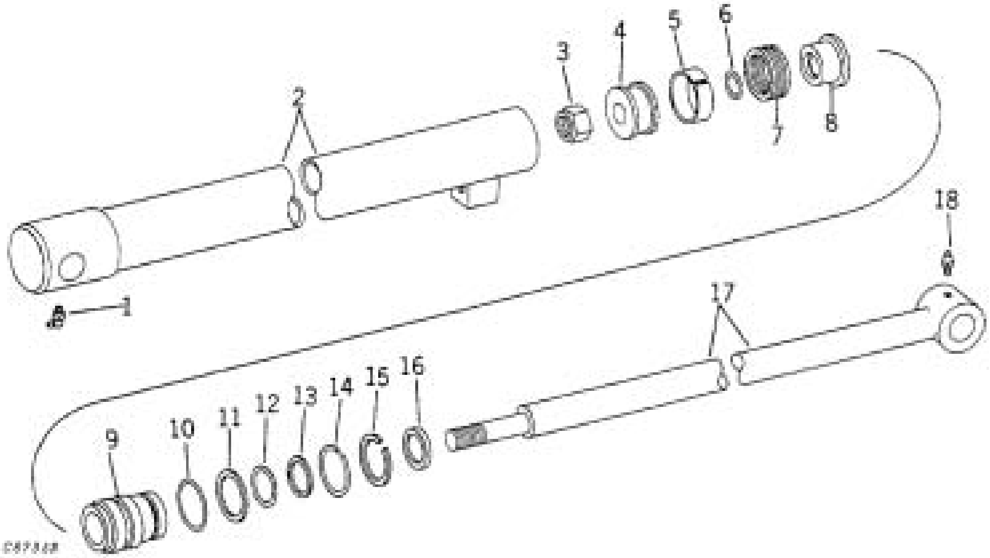
2. Check V-packings and wear rings for breaks, cuts, or embedded foreign material.

3. Check piston rod seal and wiper for wear or damage. Remove sharp edges from piston rod with emery cloth.

Installation

Install cylinder on unit. Be sure oil line fittings are clean before connecting the lines to the cylinder.

LOADER BOOM CYLINDERS



1—Grease Fitting	**5—Wear Ring**	**9—Rod Guide**	**14—Snap Ring**
2—Barrel	**6—O-Ring**	**10—O-Ring**	**15—Snap ring**
3—Stop Nut	**7—Packing**	**11—Backup Washer**	**16—Wiper Seal**
4—Piston Retainer	**8—Piston**	**12—O-Ring**	**17—Piston Rod**
		13—Backup Washer	**18—Grease Fitting**

Fig. 3-Exploded View of Boom Cylinder

Removal

Operate control valve lever until all hydraulic pressure is relieved.

Remove cylinders and cap all openings to prevent dirt entry.

If cylinder packings have failed, some fragments of the deteriorated parts may have entered the system. Completely drain the system and replace the filters.

Repair

Clamp the cylinder in a vise to prevent it from turning.

Remove rod guide and pull piston assembly from barrel.

Clamp the cylinder rod end in a vise, using care to prevent damage to the piston rod. Remove nut from end of rod. Slide parts from rod.

Wash all parts thoroughly with diesel fuel and inspect as follows:

Check barrel, rod guide, and rod for scoring. Check O-rings for surface damage.

Check V-packings and wear rings for breaks, cuts, or embedded foreign material.

Check piston rod seal and wiper for wear or damage. Remove sharp edges from piston rod with emery cloth.

Installation

Install cylinder on unit. Be sure oil line fittings are clean before connecting the lines to the cylinder.

REMOTE CYLINDERS

Removal

Disconnect hoses from couplers and remove cylinders from equipment.

Repair

Refer to Fig. 4 for reference to disassemble the remote cylinder.

Remove cylinder end cap (16). Stop and bleed valves (13) may be removed by pushing stop rod assembly into cylinder to its limit. Pull stop valve from bleed valve. After removing ball from recess, bleed valve may be removed from the stop rod.

Remove piston (22), and piston rod (36).

Push stop rod (9) all the way into cylinder to prevent distortion of stop rod while driving groove pin (25) from stop rod arm (26). Push V-packing assembly (2) from housing.

Press in a new piston rod oil seal (30) with sealing lip toward outer end of bore.

Install stop rod V-packing assembly (2) with sealing lip toward outer end of bore.

Install piston rod guide (24) and gasket (23) but do not tighten attaching hardware.

Install stop rod assembly. Use stop and bleed valve assembly to push stop rod (9) through stop rod V-packing. Tighten piston rod guide hardware to 35 lb-ft [4.8 kg-m].

Install stop rod arm (26) and groove pin (25). When installing groove pin, push stop rod (9) all the way into the cylinder to avoid bending the stop rod.

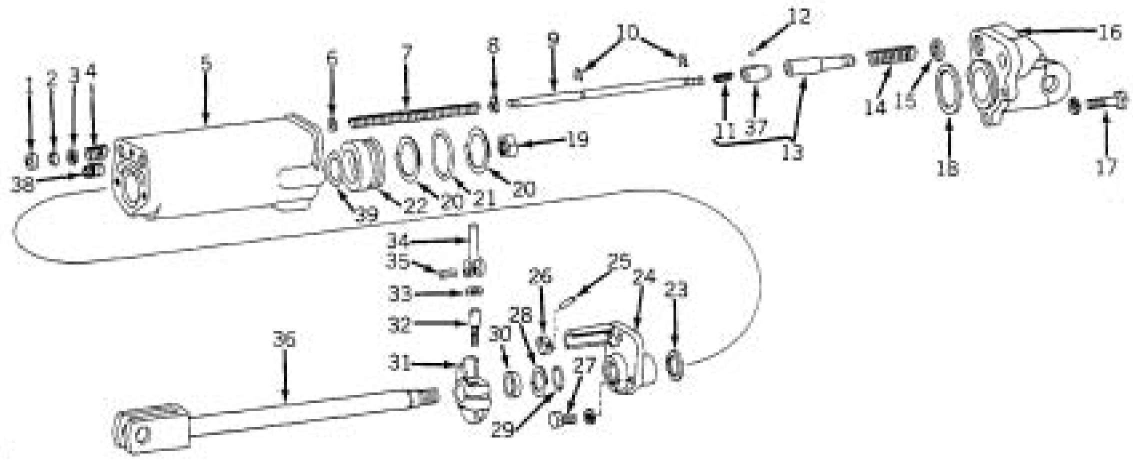
Install bleed and stop valves (13) making certain retaining ball is in the recess. Push valve assembly into the cylinder. Install piston rod (36) in cylinder.

Install O-ring packing (21) and backup rings (20) on piston.

Install piston (22) on piston rod (36). Before nut (19 or 40) is tightened, push piston well into the cylinder. Tighten nut to 300 lb-ft. [41.5 kg-m].

Locate the piston rod stop (31) on the piston rod with adjusting lever (34) opposite the stop rod arm (26).

Install gasket (18) on end cap (16). Insert two oil passage gaskets (15). Place spring (14) over end of stop valve (13) and install end cap. Tighten cap screws.



1—Stop Rod Packing Adapter
2—V-Packing (3 used)
3—Stop Rod Packing Adapter
4—Stop Rod Packing Spring
5—Remote Cylinder
6—Washer
7—Stop Rod Spring
8—Stop Rod Washer
9—Stop Rod
10—Snap Ring (2 used)
11—Bleed Valve Spring
12—Bleed Valve Ball
13—Stop and Bleed Valves
14—Stop Valve Spring
15—Oil Passage Gasket (2 used)
16—Remote Cylinder End Cap
17—Cap Screw and Lock Washer (4 used)
18—Gasket
19—Piston Nut
20—Backup Ring (2 used)
21—O-Ring
22—Piston
23—Piston Rod Guide Gasket
24—Piston Rod Guide
25—Groove Pin
26—Stop Rod Arm
27—Cap Screw and Lock Washer (3 used)
28—Backup Ring
29—O-Ring
30—Oil Seal
31—Piston Rod Stop
32—Stop Screw
33—Washer
34—Adjusting Lever
35—Spring Pin
36—Piston Rod with Yoke
37—Bleed Valve
38—Pipe Plug
39—O-Ring

Fig. 4-Hydraulic Stop Remote Cylinder

Group 70
SPECIFICATIONS AND SPECIAL TOOLS
TRANSMISSION PUMP
SPECIFICATIONS AND TORQUE VALUES

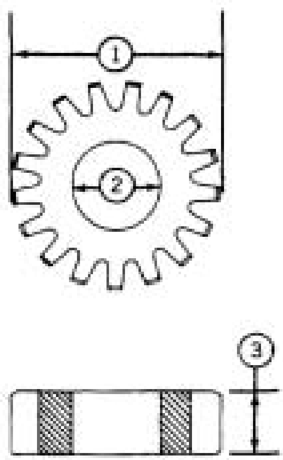


Fig. 1-Idler Gear

1 - O.D. of gear ....1.6940 to 1.6950 in. [43.027 to 43.053 mm]
2 - I.D. of gear core ....0.6495 to 0.705 in. [19.037 to 19.063 mm]
3 - Width of gear......................0.5075 to 0.5095 in. [12.891 to 12.941 mm]

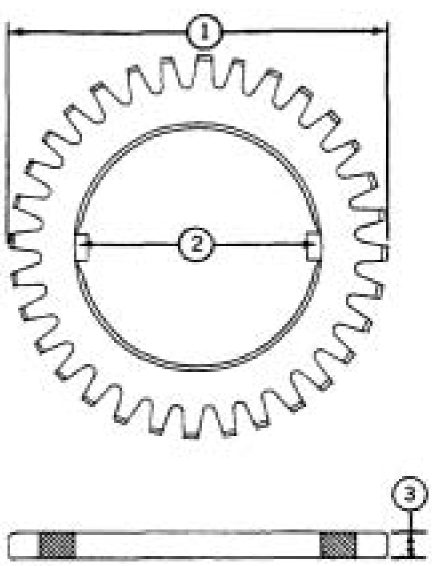


Fig. 2-Drive Gear

1 - O.D. of gear ....3.0288 to 3.0308 in. [76.932 to 76.982 mm]
2 - I.D. of gear bore ....1.9660 to 1.9710 in. [49.94 to 50.06 mm]
3 - Width of gear......................0.5075 to 0.5095 in. [12.891 to 12.941 mm]

MAIN HYDRAULIC PUMP

SPECIFICATIONS AND TORQUE VALUES

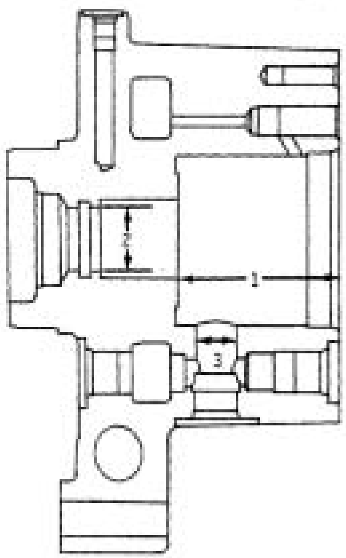


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Fig. 3-Main Hydraulic Pump

1 - Housing finished face to bottom of cam and race bore ....2.6600 to 2.6660 in. [67.564 to 67.716 mm]

2 - I.D. pump housing behind shaft O-ring....................................1.0400 to 1.0800 in. [26.416 to 27.432 mm]

3 - I.D. of piston bores ....0.6802 to 0.6808 in. [17.277 to 17.292 mm]

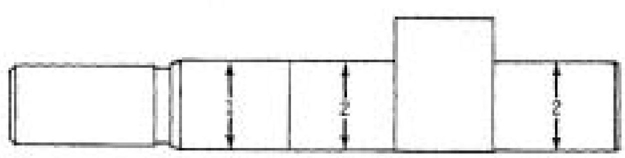

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Fig. 4-Hydraulic Pump Shaft

1 - O.D. pump shaft at O-ring area
(R39177) ....0.9990 to 1.0010 in. [25.375 to 25.425 mm]
(R39319) ....0.9985 to 0.9995 in. [25.362 to 25.387 mm]

2 - O.D. pump shaft at bushing area.
(R39177) ....1.0019 to 1.0025 in. [25.448 to 25.463 mm]
(R39319) ....0.9994 to 1.0000 in. [25.385 to 25.400 mm]

MAIN HYDRAULIC PUMP

SPECIFICATIONS AND TORQUE VALUES—Continued

1 - O.D. of piston ....0.6795 to 0.6799 in. [17.259 to 17.269 mm]

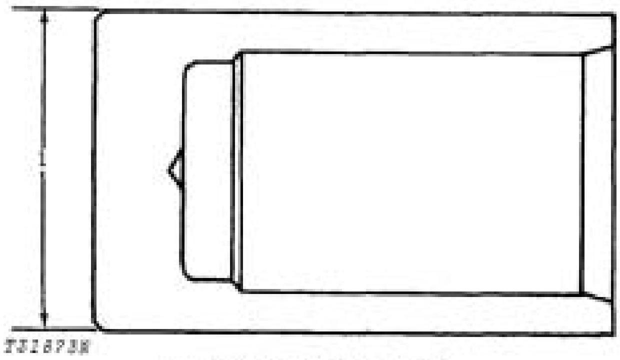

Fig. 5-Hydraulic Pump Piston

1 - Thickness of shaft thrust washer.......................0.0870 to 0.0910 in. [2.21 to 2.31 mm]

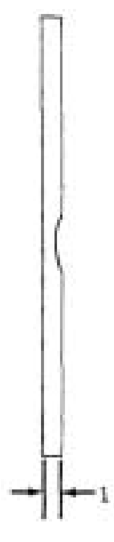

Fig. 6-Shaft Thrust Washer

1 - I.D. of cam race.................1.8004 to 1.8010 in. [45.730 to 45.746 mm]

2 - O.D. of cam race ....2.2350 to 2.2450 in. [56.77 to 57.03 mm]

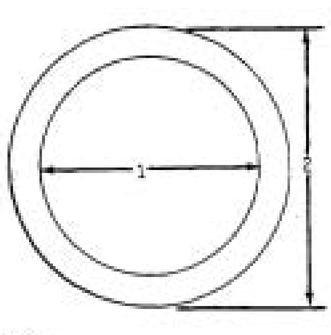

Fig. 7-Cam Race

MAIN HYDRAULIC PUMP

SPECIFICATIONS AND TORQUE VALUES—Continued

1 - Pump shaft end play............0.0040 to 0.380 in.
[0.102 to 9.652 mm]

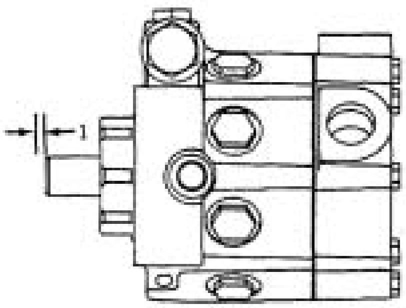

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Fig. 8-Pump Shaft End Play

1 - Outlet valve diameter ....0.600 to 0.620 in.
[15.24 to 15.74 mm]

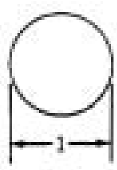

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Fig. 9-Outlet Valve

1 - Pump shaft needle bearing below housing or cover finished surface ....0.020 in.
[0.51 mm].

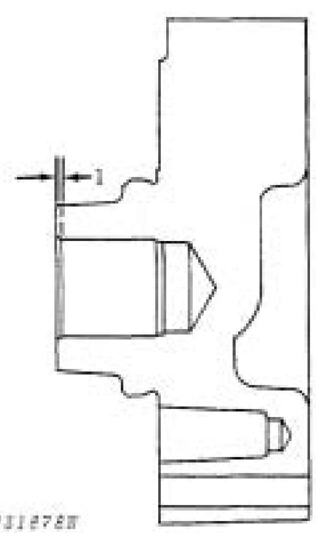

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Fig. 10-Pump Housing Cover

MAIN HYDRAULIC PUMP

SPECIFICATIONS AND TORQUE VALVES—Continued

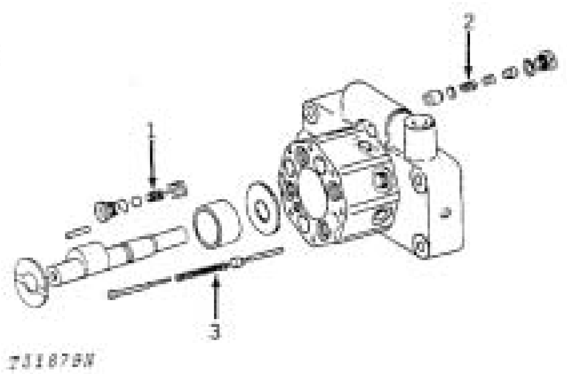


Fig. 11-Pump Springs

1 - Inlet valve spring free length .... 0.51 in. [12.95 mm]
Test length is 0.31 in. [7.87 m] with 0.31 to 0.39 pounds [0.14 to 0.18 kg].

2 - Outlet valve spring free length............... 0.48 in. [12.19 mm]
Test length is 0.30 in. [7.62 mm] with 2.54 to 3.14 pounds [1.15 to 1.42 kg].

3 - Crankcase outlet valve spring free length .... 2.50 in. [63.50 mm]
Test length is 2.06 in. [52.32 mm] with 44 to 54 pounds [19.96 to 24.49 kg].

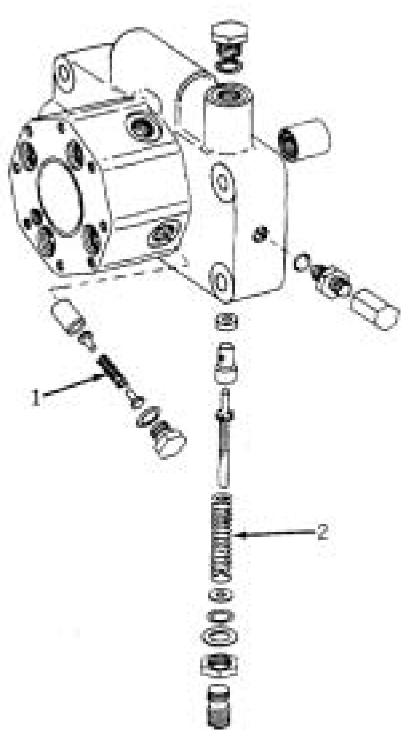


Fig. 12-Pump Piston and Stroke Control Valve Springs

1 - Piston springs matched to within 0.15 pounds [0.07 kg] of each other when compressed to 1.25 in. [31.75 mm] length.

2 - Stroke control valve spring free length .... 2.87 in. [72.90 mm]
Test length is 2.50 in. [63.50 mm] with 158 to 192 pounds [71.67 to 87.09 kg].

MAIN HYDRAULIC PUMP

SPECIFICATIONS AND TORQUE VALUES—Continued

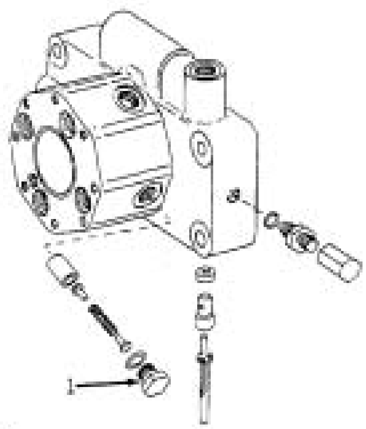


Fig. 13-Piston Plugs Torque

1 - Pump piston plugs torque ....100 lb-ft. [13.82 kg-m]

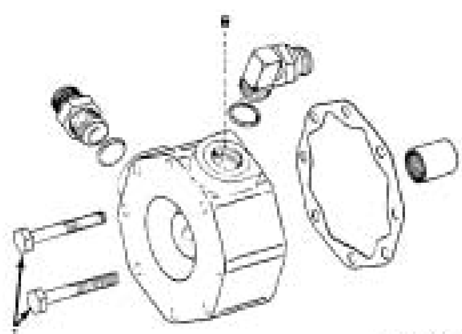


Fig. 14-Pump Cover Cap Screws

1 - Pump cover to body cap screws torque ....36 lb-ft. [4.98 kg-m]

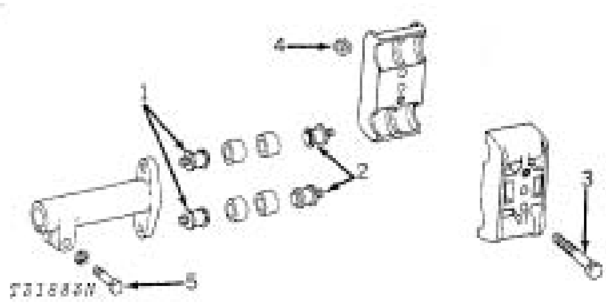


Fig. 15-Pump Drive

1 - Pump drive screws to pump drive shaft torque . . . . .35 lb-ft. [4.8 kg-m]

2 - Pump drive screws to crankshaft pulley torque . . . . .35 lb-ft. [4.8 kg-m]

3 - Pump drive coupler cap screws torque . . . . .25 lb-ft. [3.4 kg-m]

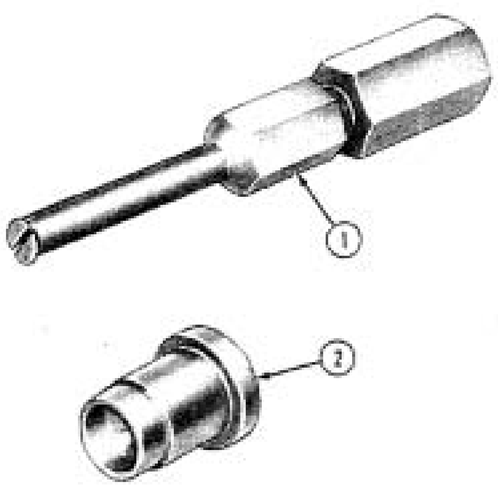
4 - Coupler screw lock nuts torque . . . . . . 25 lb-ft. [3.4 kg-m]

5 - Pump drive shaft retaining screw torque . . . . .32 lb-ft. [4.4 kg-m]

MAIN HYDRAULIC PUMP

SPECIAL TOOLS

Essential Tools

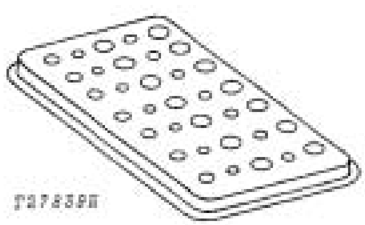
Tool	Tool Number	Use
	1 - JDH-40 Seat Puller	To remove outlet valve seats from pump housing.
	2 - JDH-39A	To install outlet valve seat to the correct depth in pump housing.

T460997

Fig. 16-Outlet Valve Seat Replacement Tools

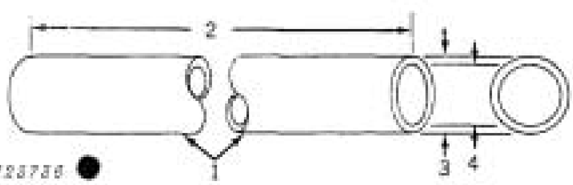
Tool Number	Use
JDH-21	Parts tray for pump pistons, inlet valves, discharge valves and plugs.

Convenience Tools

Tool	Tool Number	Use
		

T278398

Fig. 17-Pump Parts Tray

Tool	Tool Number	Use
	*	To install discharge valve seat

T23736

1—Tubing
2—2 to 4 in.
3—O.D. - 0.625 in. [15.87 mm]
4—I.D. - 0.500 in. [12.70 mm]

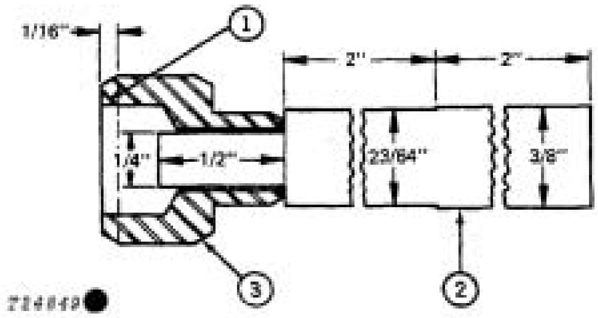
Fig. 18-Discharge Valve Seat Installation Tool

*Make in dealers shop.

MAIN HYDRAULIC PUMP

SPECIAL TOOLS—Continued

Convenience Tools—Cont.

Tool	Tool Number	Use
	**. . .	To remove inlet valve assembly.

1—Grind Off Chamfer
2—Driver Rod
3—R27157 Guide

Fig. 19-Inlet Valve Removal Tool

**Make in dealer's shop.

REVERSER CLUTCH CONTROL VALVE

SPECIFICATIONS AND SPECIAL TOOLS

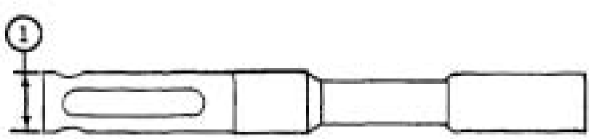


Fig. 20-Pressure Clutch Valve

1 - O.D. of pressure clutch valve .... 0.673 to 0.677 in. [17.09 to 17.19 mm]

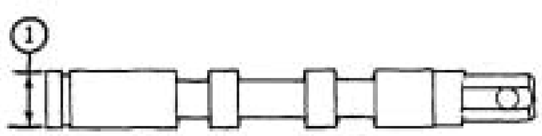


Fig. 21-Clutch Control Valve

1 - O.D. of clutch control valve .... 0.6852 to 0.6862 in. [17.404 to 17.430 mm]

REVERSER CLUTCH CONTROL VALVE

SPECIFICATIONS AND SPECIAL TOOLS—Continued

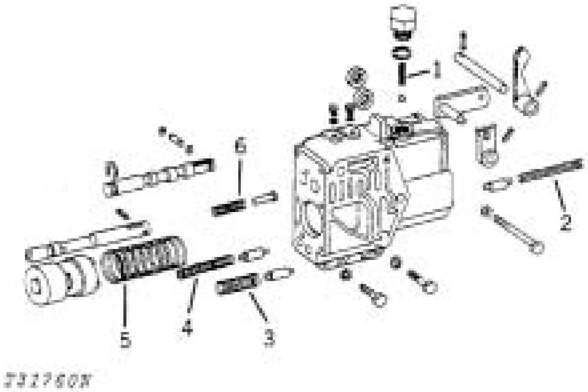


Fig. 22-Reverser Clutch Control Valve

1 - Detent spring free length........................ 1.16 in. [29.5 mm]
Detent spring test length........................ 0.83 in. [21.1 mm] with 6.5 ± 0.65 lbs. [3.0 ± 0.3 kg]
2 - Pressure regulating valve spring free length........................ 3.27 in. [83.0 mm]
Pressure regulating valve spring test length........................ 2.56 in. [65.0 mm] with 29.4 ± 02.9 lbs. [13.34 ± 1.32 kg]
3 - Lube reduction valve spring free length........................ 2.06 in. [52.5 mm]
Lube reduction valve spring test length........................ 0.75 in. [19.0 mm] with 4.3 ± 0.4 lbs. [1.95 ± 0.19 kg]
4 - Cooler bypass and relief valve spring free length........................ 2.80 in. [71.0 mm]
Cooler bypass and relief valve spring test length........................ 2.05 in. [52.0 mm] with 20 ± 2 lbs. [9 ± 0.9 kg]
5 - Accumulator spring free length........................ 3.62 in. [92.0 mm]
Accumulator spring test length........................ 2.62 in. [66.5 mm] with 313 ± 31 lbs. [142 ± 14.2 kg]
6 - Clutch control valve spring free length........................ 1.63 in. [41.5 mm]
Clutch control valve spring test length........................ 1.12 in. [28.5 mm] with 33 ± 3.3 lbs. [75.0 ± 1.5 kg]

PRESSURE CONTROL VALVE

SPECIFICATIONS AND SPECIAL TOOLS—Continued

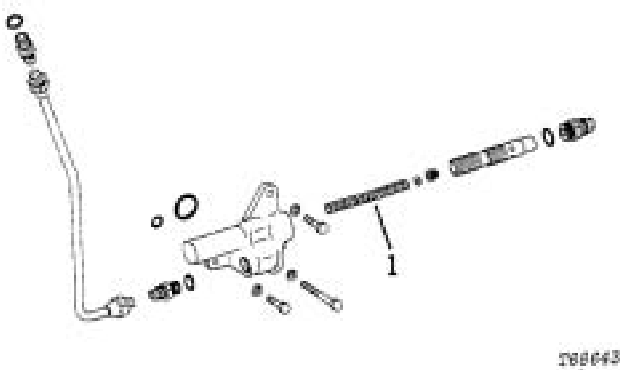


Fig. 23-Pressure Control Valve

1 - Valve spring free length .... 4.61 in. [117.0 mm]
Valve spring test length .... 3.24 in. [82.3 mm] with 62 ± .62 lbs. [28.14 ± 2.81 kg]

STEERING VALVE

SPECIFICATIONS AND TORQUE VALUES

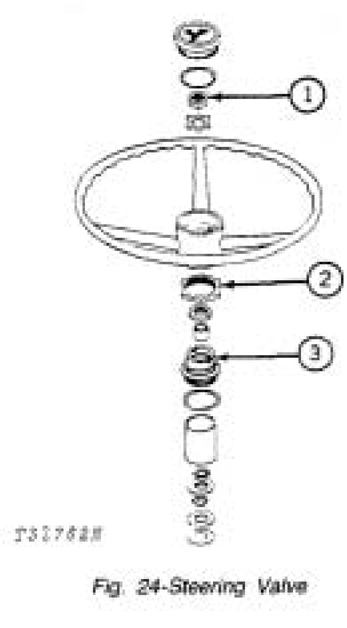


Fig. 24-Steering Valve

1 - Steering wheel hex. nut .... 50 lb-ft. [6.91 kg-m]
2 - Adjuster jam nut .... 30 lb-ft. [4.18 kg-m]
3 - Shaft adjuster .... 50 lb-ft. [6.91 kg-m]

STEERING VALVE

SPECIFICATIONS AND TORQUE VALUES—Continued

Fig. 25-Steering Valve Housing

1 - Steering wheel shaft preload ....0.0010 to 0.0030 in. [0.0254 to 0.0762 mm]

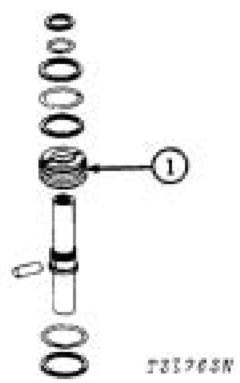


Fig. 26-Steering Valve Piston

1 - Piston to piston rod torque ....250 lb-ft. [34.56 kg-m]

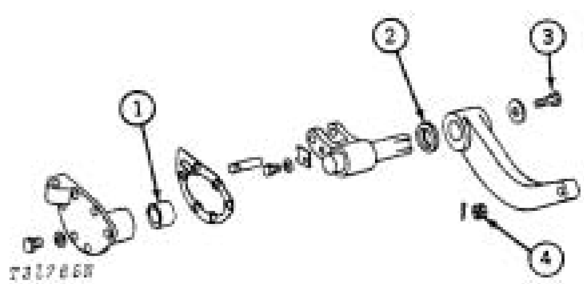


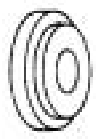
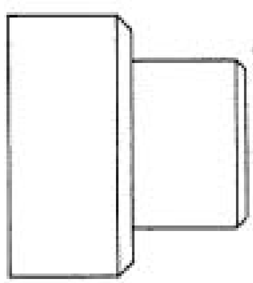
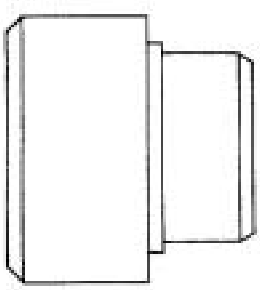
Fig. 27-Steering Arm and Drag Link

1 - Steering arm bushing pressed into bore ....flush to 0.0300 in. [0.762 mm] below face of bore.
2 - Steering arm oil seal pressed in bore......................................flush with bottom of bore chamfer.
3 - Steering shaft arm to shaft..................190 lb-ft. [26.26 kg-m]
4 - Drag link to steering shaft arm slotted nut..55 lb-ft. [7.60 kg-m]

STEERING VALVE

SPECIAL TOOLS

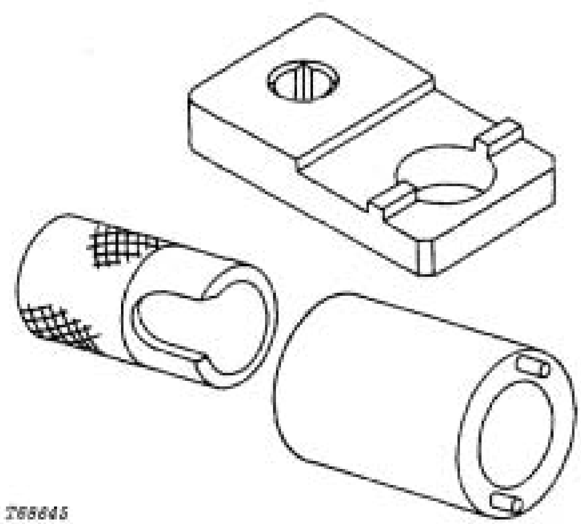
Convenience Tools

Tool	Tool Number	Use
 T21766N *Fig. 28-Bushing and Oil Seal Drive*	JD252	To install bushings and oil seal in lower steering linkage assembly.
 T21767N *Fig. 29-Adjuster Bushing Installing Tool*	M618	To install bushing in adjuster
 T21768N *Fig. 30-Adjuster Oil Seal Installing Tool*	AM554	To install oil seal in adjuster

STEERING VALVE

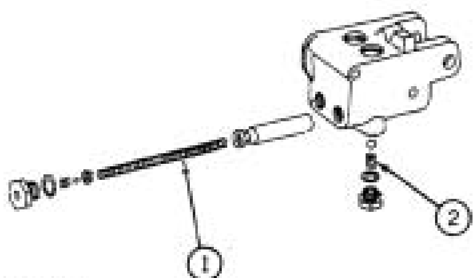
SPECIAL TOOLS—Continued

Convenience Tools—Continued

Tool	Tool Number	Use
 T65645 Fig. 31-Steering Valve Service Set	JDH-41	To service steering valve.
	Consists of:	
	JDH-41-1-B	Power Steering Spanner Wrench.
	JDH-41-2	Spring Compressor and Snap Ring Removal and Installation Tool.
	JDH-41-3	Piston Spanner Wrench.

BRAKE VALVE

SPECIFICATIONS AND TORQUE VALUES



T81769N

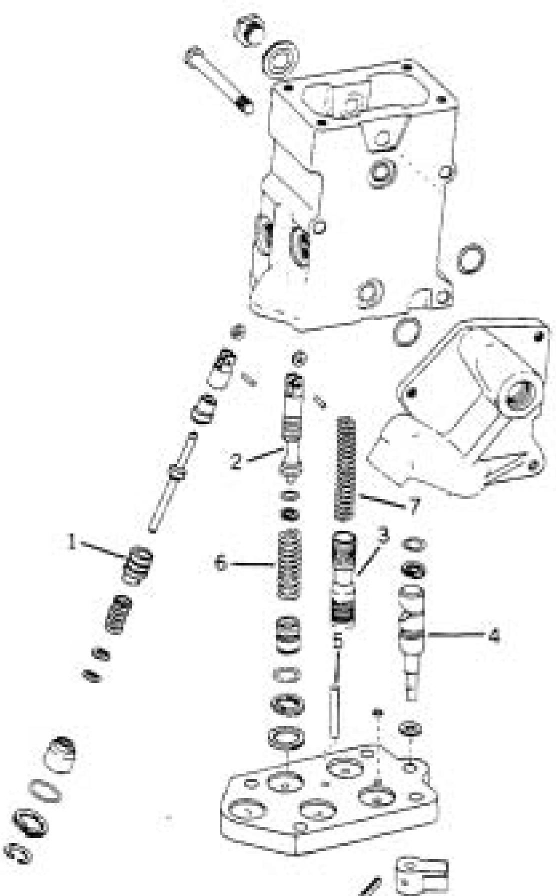
Fig. 32-Brake Valve

1 - Piston spring free length .... 7.50 in. [190.5 mm]
Piston spring test length .... 5.75 in. [146.0 mm] with 20 ± 2 lbs. [9.07 ± 0.91 kg]

2 - Check valve spring free length .... 0.79 in. [20.0 mm]
Check valve spring test length .... 0.28 in. [7.0 mm] with 0.15 ± 0.02 lbs. [0.068 ± 0.009 kg]

SELECTIVE CONTROL VALVE

SPECIFICATIONS AND TORQUE VALUES



T81777N

Fig. 33-Selective Control Valve

1 - O.D. of detent piston ....0.6480 to 0.7500 in. [16.459 to 19.050 mm]

2 - O.D. of pressure and return valves ....0.4960 to 0.4970 in. [12.598 to 12.624 mm]
Pressure and return valve adjustment
Pressure valve to cam (in neutral) .... 0.064 ± 0.016 in. [1.6 ± 0.41 mm]
Return valve to cam (in neutral) .... 0.024 ± 0.016 in. [0.61 ± 0.41 mm]

3 - O.D. flow control valve ......0.7480 to 0.7490 in. [18.999 to 19.025 mm]

4 - O.D. of metering valve ......0.6235 to 0.6245 in. [15.837 to 15.862 mm]

5 - Flow control valve stop pin exposed length .... 0.937 in. [23.80 mm]

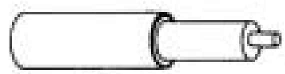
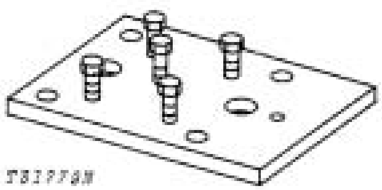
6 - Pressure valve spring free length .... 1.81 in. [45.97 mm]
Pressure valve spring test length .... 1.25 in. [31.75 mm] with 40 pounds [18.14 kg]
Return valve spring free length .... 1.56 in. [39.62 mm]
Return valve spring test length .... 1.25 in. [31.75 mm] with 21 pounds [9.52 kg]

7 - Flow control valve spring free length .... 2.94 in. [74.68 mm]
Flow control valve spring test length .... 2.12 in. [53.85 mm] with 45 pounds [20.41 kg]

SELECTIVE CONTROL VALVE

SPECIAL TOOLS

Essential Tools

Tool	Tool Number	Use
 T81778N *Fig. 34-Driver*	JDH-28	To install inner detent guide
 T81779N *Fig. 35-Adjusting Cover*	JDH-15C	To adjust selective control valve

ROCKSHAFT SYSTEM

SPECIFICATIONS AND TORQUE VALUES

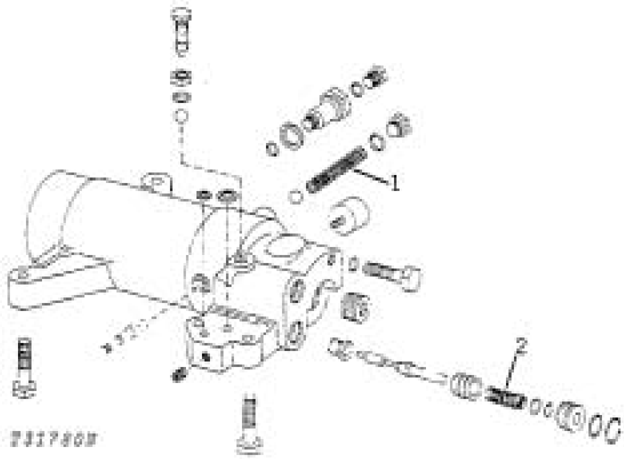


Fig. 36-Rockshaft Cylinder and Valve Housing

1 - Check valve spring free length .... 3.69 in. [93.73 mm]
Check valve spring test length .... 2.56 in. [65.02 mm] with 14 ± 1.5 pounds [6.35 ± 0.23 kg]

2 - Control valve spring free length .... 1.31 in. [33.27 mm]
Control valve spring test length .... 0.87 in. [22.10 mm] with 8.31 pounds [3.77 kg]

MISCELLANEOUS HYDRAULIC COMPONENTS

SPECIFICATIONS AND TORQUE VALUES

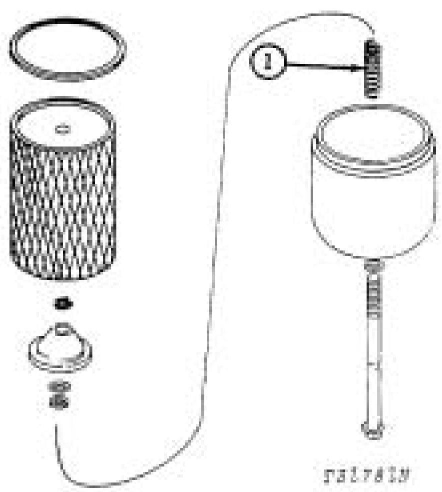


Fig. 37-Transmission Filter Assembly

1 - Transmission filter relief valve spring free length .... 2.56 in. [65.02 mm]
Transmission filter relief valve spring test length .... 1.31 in. [33.27 mm] with 10 ± 0.5 pound [4.5 ± 0.2 kg]

MISCELLANEOUS HYDRAULIC COMPONENTS

SPECIFICATIONS AND TORQUE VALUES—Continued

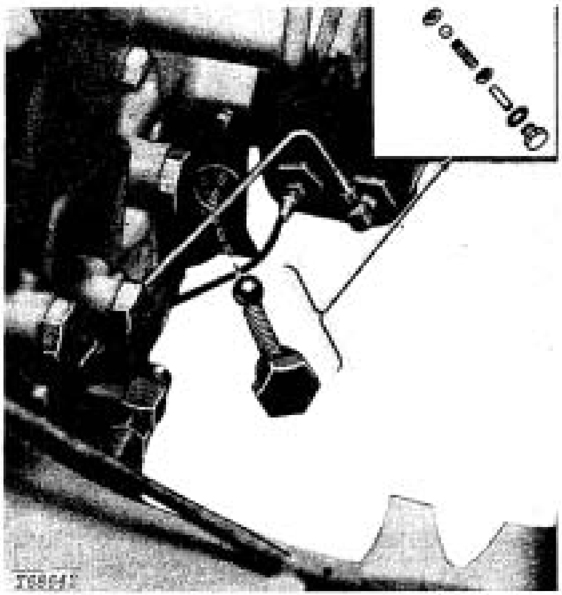


Fig. 38-Transmission Pump Relief Valve

1 - Transmission oil pump relief valve spring free length .... 1.87 in. [47.50 mm]
Transmission oil pump relief valve spring test length .... 1.12 in. [28.45 mm] with 30.5 to 37.5 pounds [13.8 to 17.0 kg]

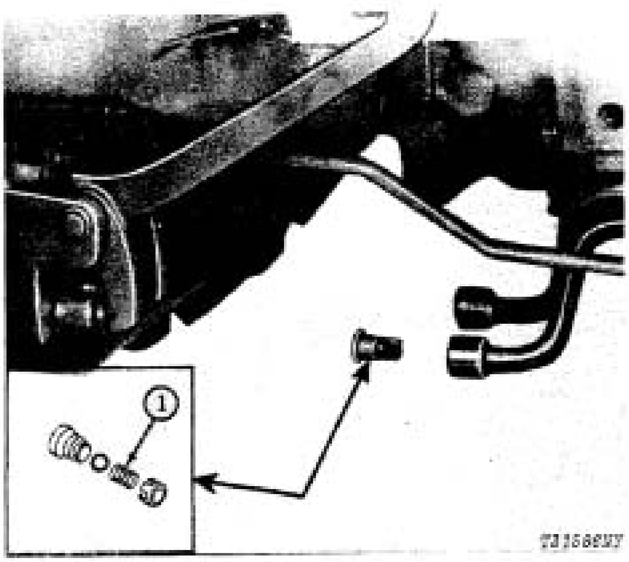


Fig. 39-Inlet Line Check Valve

1 - Inlet line check valve spring free length.............................. 0.5 in. [12.7 mm]
Inlet line check valve spring test length .... 0.31 [7.9 mm] with 5 to 7 oz. [141.7 to 170.1 g]

LOADER BUCKET CYLINDERS

SPECIFICATIONS AND TORQUE VALUES

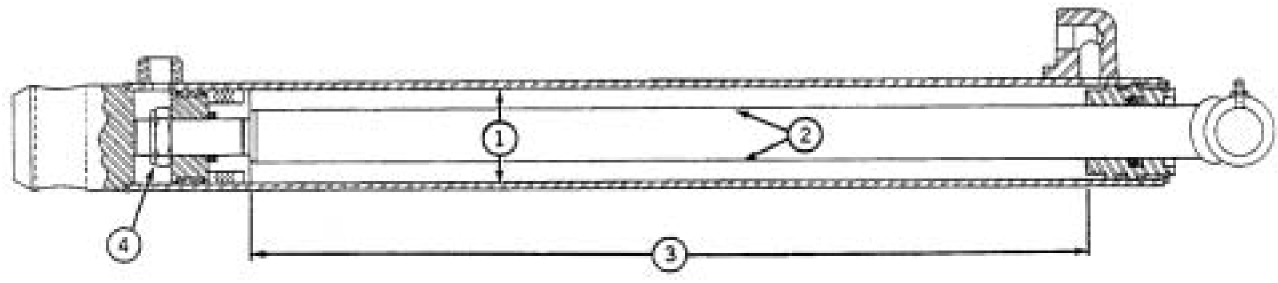


Fig. 40-Loader Bucket Cylinder

1 - Cylinder bore .... 2.25 in. [57.0 mm]
2 - Rod diameter .... 1.25 in. [32.0 mm]
3 - Cylinder stroke .... 19.62 in. [498.5 mm]
4 - Special nut torque .... 130 to 160 lb-ft. [18 to 22 kg-m]

LOADER BOOM CYLINDERS

SPECIFICATIONS AND TORQUE VALUES

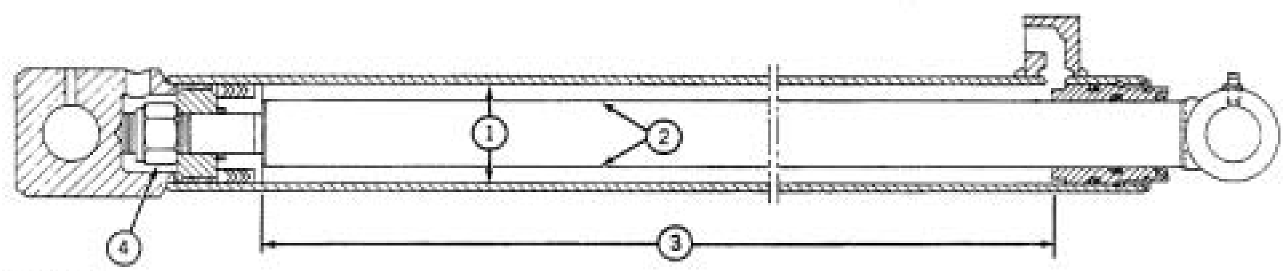


Fig. 41-Loader Boom Cylinder

1 - Cylinder bore .... 2.25 in. [57.0 mm]
2 - Rod diameter .... 1.50 in. [38.1 mm]
3 - Cylinder stroke .... 32.50 in. [825.5 mm]
4 - Special nut torque .... 150 to 250 lb-ft. [20.7 to 34.6 kg-m]

Section 60
MISCELLANEOUS COMPONENTS

CONTENTS OF THIS SECTION

Group 5
MANUAL STEERING

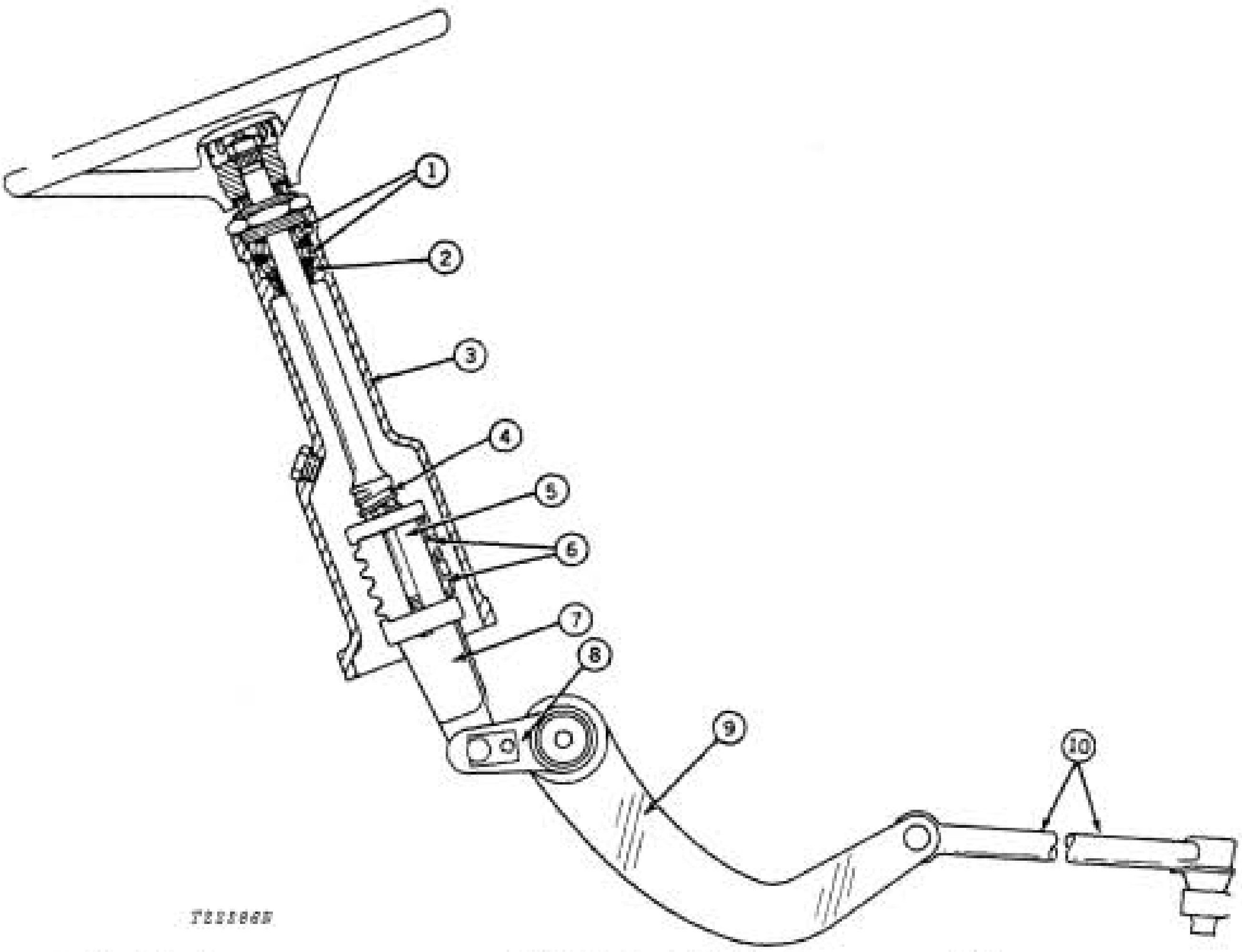
GENERAL INFORMATION

In operation, when the steering wheel is turned right, the worm on the fixed steering wheel shaft threads the ball nut upward. The steering shaft is turned, moving steering shaft arm and drag link rearward to turn the tractor front wheels to the right.

During a left turn, the operation of the steering gears and linkage is reversed from that of a right turn.

Ball Nut Operation

The ball nut is threaded over the worm portion of the shaft. The bore of the nut has helical grooves corresponding to grooves in the shaft worm. These grooves within the ball nut are filled with steel balls making up two separate circuits of recirculating balls. To complete each circuit and to keep the balls from running out at the ends, the ball nut is equipped with ball guides. Each guide deflects the balls from their helical path when they reach the end of the ball nut, thus returning the balls to the helical path in the ball nut at the start of a circuit.



1—Barrel Bearings
2—Oil Seal
3—Steering Wheel Shaft Housing
4—Steering Wheel Shaft Worm
5—Ball Nut
6—Ball Guide
7_Yoke
8—Steering Shaft
9—Steering Shaft Arm
10—Steering Drag Link

Fig. 1-Manual Steering Assembly

REMOVAL

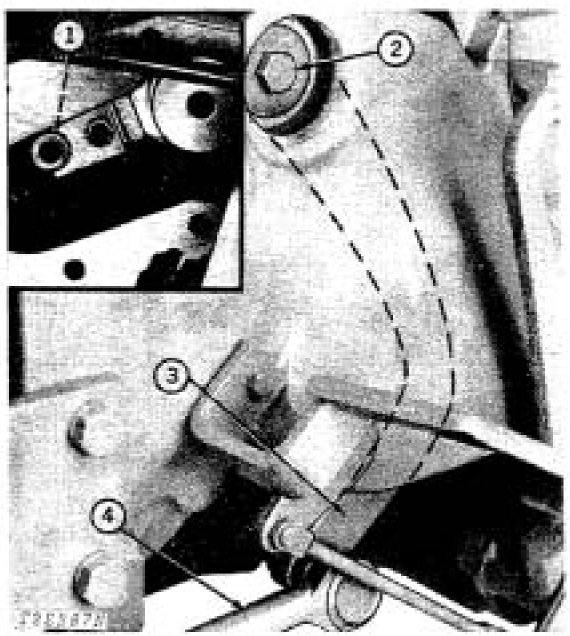
1. Use a puller to remove steering wheel.

2. Drain oil from steering gear housing by removing drain plug on right side of clutch housing below steering shaft cover.

3. If tractor is equipped with foot throttle, disconnect pedal from rod and lift pedal to obtain clearance when removing steering shaft cover.

4. Remove steering shaft cover and gasket. Locate steering yoke-to-shaft pin and retainer plate (inset, Fig. 2). Remove pin retainer plate and thread a 3/8-inch [9.53 mm] cap screw into pin. Pull pin from yoke.

5. Take out cap screws securing steering gear to clutch housing and dash assembly. Lift steering gear away from tractor.



1—"R" on This Side
2—Attaching Cap Screw
3—Steering Shaft Arm
4—Drag Link

Fig. 2-Removing Manual Steering Assembly

REPAIR

Disassembly

Refer to Figure 3 during disassembly.

Remove adjuster lock nut and using a spanner wrench, unscrew adjuster from steering gear housing.

Pull upward on steering wheel shaft until bearings and thrust washer halves are exposed.

Slide upper barrel bearing from shaft.

Using a snap ring pliers, remove snap ring, thrust washer halves, and lower bearing from shaft.

Pull steering wheel shaft, ball nut, and yoke from bottom of steering gear housing.

Separate yoke from ball nut by removing two cap screws and retainer.

Examine oil seal (7) in steering wheel shaft. If necessary, press in new oil seal with steel face opposite bottom of seal bore.

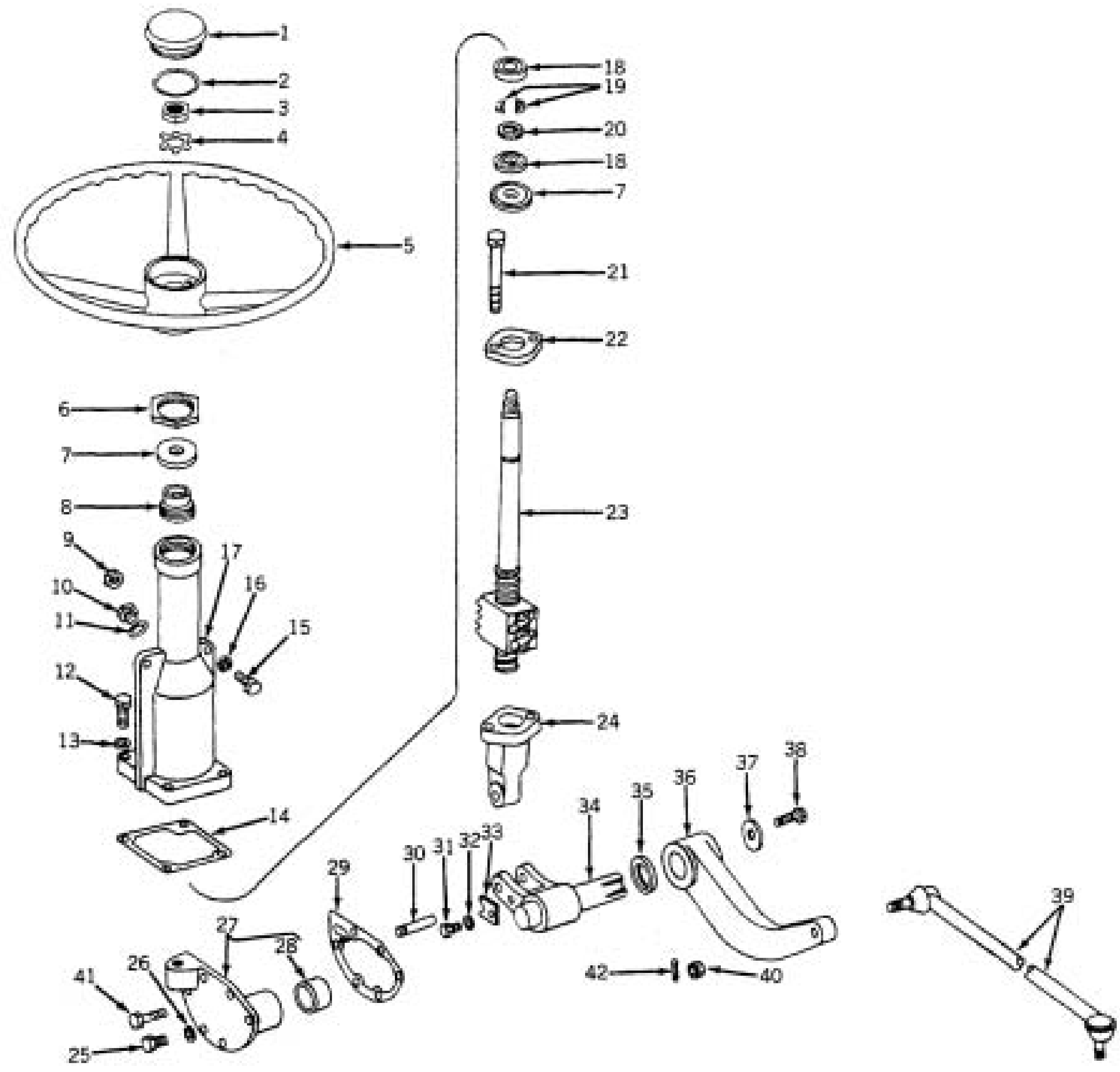
Inspect barrel bearings (18) for wear or damage. Rollers must be free to turn.

Check steering wheel shaft (23) for damaged or cracked worm. Check ball nut for smooth rotation. Replace steering wheel shaft and ball nut assembly if unserviceable.

Examine steering shaft oil seal (35) in clutch housing for damage. Use JD252 Driver and press seal into clutch housing with lips facing bottom of bore and opposite side flush with chamfered edge of bore face.

Inspect steering shaft cover (27) for damage.

Check bushing (28) in cover for wear. Use JD252 Driver to press in new bushing flush with outer edge of bushing bore.



1—Emblem
2—O-Ring Packing
3—Jam Nut
4—Special Lock Washer
5—Steering Wheel
6—Special Jam Nut
7—Oil Seal (2 used)
8—Bearing Adjuster
9—Nut (2 used)
10—Plug
11—O-Ring
12—Cap Screw (4 used)
13—Lock Washer (4 used)
14—Gasket
15—Cap Screw (2 used)
16—Lock Washer (2 used)
17—Steering Wheel Shaft Housing
18—Barrel Bearing (2 used)
19—Special Thrust Half Washer (2 used)
20—Snap Ring
21—Cap Screw (2 used)
22—Yoke Retainer
23—Steering Wheel Shaft with Ball Nut
24—Steering Wheel Shaft Yoke
25—Cap Screw (5 used)
26—Lock Washer (6 used)
27—Steering Shaft Cover with Bushing
28—Bushing
29—Gasket
30—Pin
31—Cap Screw
32—Lock Washer
33—Plate
34—Steering Shaft and Yoke
35—Oil Seal
36—Steering Shaft Arm
37—Special Washer
38—Cap Screw
39—Drag Link
40—Slotted Nut (2 used)
41—Cap Screw
42—Cotter Pin (2 used)

Fig. 3-Steering Gear and Linkage

Assembly

Refer to Figure 3 for position of parts during assembly of steering gear.

Assemble locating step on yoke and retainer to rack side of ball nut. Secure yoke with two cap screws provided and tighten to standard torque.

Liberally grease threaded end of steering wheel shaft and insert shaft, ball nut, and yoke into bottom of housing as far as assembly will go (rack side of ball nut to rear of housing). Turn steering wheel shaft counterclockwise out of ball nut until it stops.

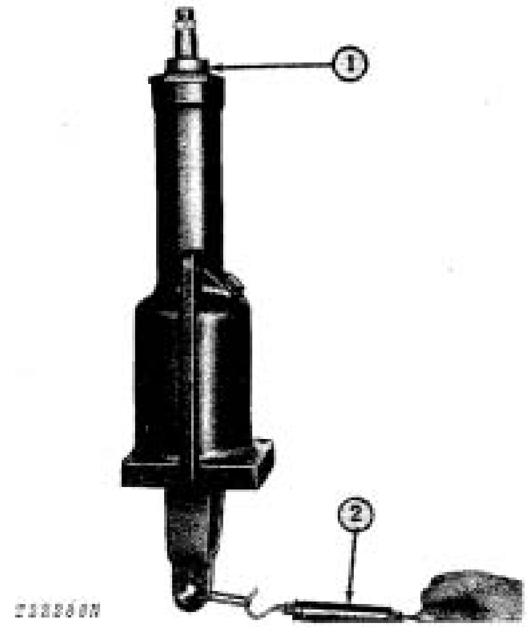
Pack barrel bearing with grease and place over steering wheel shaft so that bottom of rollers point toward shaft.

Place thrust washer halves together in groove of steering wheel shaft and secure with snap ring.

Push steering wheel shaft into housing until bearing is seated on ridge in housing. Pack grease around bearing and thrust washer halves and install other barrel bearing (opposite that of lower bearing).

Install bearing adjuster, with oil seal, in steering gear housing. Be sure splined end of shaft and oil seal lips are greased when adjuster is installed.

ADJUSTMENT



1—Bearing Adjuster 2—Lateral Pull

Fig. 4-Steering Wheel Shaft Bearing Adjustment

Place steering gear assembly in a vertical position with ball nut all the way down on steering wheel shaft worm and hook a spring scale in pivot pin hole in steering yoke. Tighten bearing adjuster until 15 to 17 lbs. [6.80 to 7.71 kg] force is required to move yoke and steering wheel shaft from side to side within the housing (Fig. 4). After adjustment is made, tighten adjuster jam nut to 75 lb-ft. [10.37 kg-m].

INSTALLATION

Position steering gear assembly over steering yoke compartment in clutch housing allowing steering yoke to slide between forked portion of steering shaft. Use a new gasket between steering gear housing and clutch housing.

When positioning steering gear, be sure that side of yoke marked "R" is toward the right side of the tractor (see inset, Fig. 2).

Secure steering gear to clutch housing and dash assembly.

Be sure steering housing gasket is turned so that inside tab is on left rear corner.

Install steering yoke to shaft pin and lock in place with retainer (inset, Fig. 2). Tighten retainer cap screw to standard torque.

Install steering shaft cover using new gasket.

Fill steering gear with quantity and type of lubricant described in Section 10, Group 15.

Install steering wheel and count number of turns required to turn from left to right, then turn back one-half this number of turns. Reposition steering wheel with one spoke pointing downward in vertical center-line of steering gear housing.

Place bent tab of special lock washer in puller hole of steering wheel hub. Install hex. nut and tighten to specifications. Bend up two tabs of washer around nut and install steering wheel button plug.

With tractor front wheels in straight ahead position and steering gear centered, drag link should just fit into hole on steering shaft arm. Tighten drag link-to-steering shaft arm nut to specifications. Advance nut to line up holes and install cotter pins.

Adjust tie rods for straight ahead position and check toe-in as described in Section 70, Group 30.

Turn steering wheel full right and left. Stops on spindle knuckles should contact stops on knees. Adjust tie rods as described in Section 70, Group 30.

Group 10
FRONT END ASSEMBLY
FRONT END SUPPORT

GENERAL INFORMATION

The front end support serves as a mounting for the radiator, hydraulic pump, fuel tank and air cleaner.

The swept-back solid or adjustable front axle mounts on the front end support. Swept-back axles give a shorter turning radius for sharper turns in close quarters.

REMOVAL

CAUTION: Remove battery ground strap for safety.

Remove loader (see Group 15 of this section).

Remove front ballast (if used).

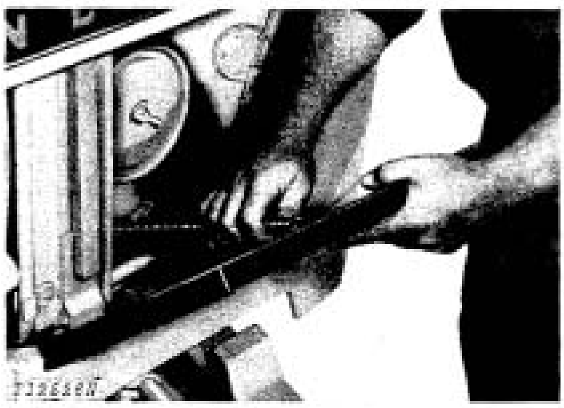
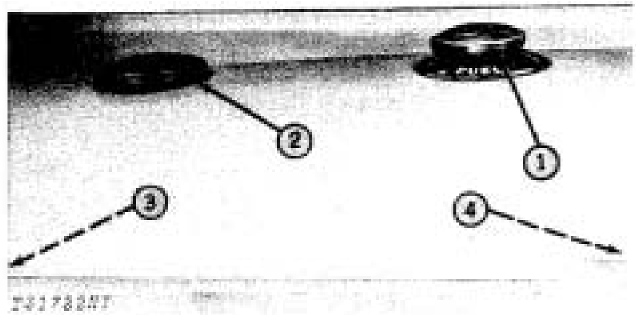


Fig. 1-Removing Grille Screens

Pull out on top edge of each grille screen. Lift screen to clear pins in front end support. Disconnect springs (Fig. 1) and remove screens.



1—Fuel Tank Cap
2—Radiator Cap
3—Cap Screw
4—Nuts

Fig. 2-Hood Attaching Point

Remove the radiator cap and fuel tank cap. Remove the cap screws securing hood to grille housing. Remove the cap screw on each side at rear of hood. Lift off hood.

IMPORTANT: Install radiator cap and fuel tank cap to prevent dirt from entering systems.

Remove tool box from tractor side frames (if equipped) and remove side frames.

Remove radiator top support rod from radiator. Disconnect fuel return line from tank (diesel).

Disconnect fuel gauge sender wire from fuel tank.

Disconnect all bleed lines from top of hydraulic oil reservoir.

Disconnect air cleaner hose from intake manifold (diesel) or carburetor (gasoline). Remove intake tube.

Drain radiator and disconnect water inlet and outlet hoses. Remove return line from hydraulic oil reservoir.

If tractor is equipped with a reverser, also disconnect cooler return line from bottom of oil cooler and cooler inlet line from top of cooler.

Remove fan shroud from radiator and slip back over fan. Remove cap screws securing radiator to front end support mounting pads and slide radiator out left side of tractor (Fig. 3).

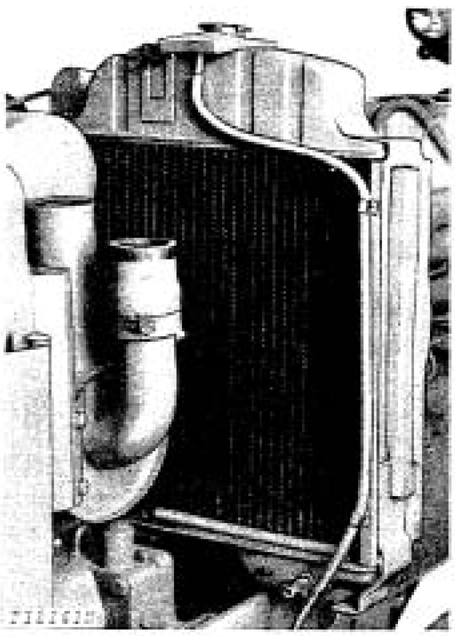


Fig. 3-Removing Radiator
(Unit Without Reverser Shown)

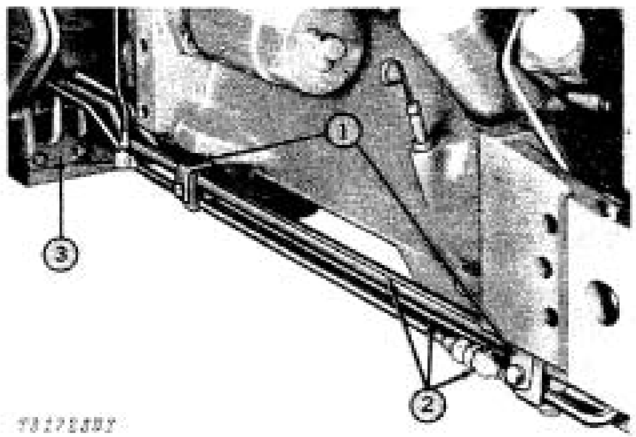
Close fuel shut-off valve at bottom of fuel tank by screwing in until finger tight.

Disconnect fuel line between fuel tank and fuel transfer pump.

Remove fuel transfer pump from engine. Remove fuel inlet line.

Loosen cap screws in hydraulic pump solid drive coupling (see Fig. 5).

NOTE: Do not lose key from drive coupling when pump shaft is pulled from coupling.



1—Clamps **3—Retainer**
2—Hydraulic Lines

Fig. 4-Hydraulic Lines Without Reverser

Remove clamps securing hydraulic oil line to engine oil pan (Fig. 4). On tractors with power steering, disconnect power steering system outlet line from nipple on main pump inlet line.

Remove retainer from main pump inlet line and reservoir return line at front of clutch housing.

NOTE: Do not lose check valve assembly in end of main pump inlet line when pulling line.

Disconnect main hydraulic pump pressure line at connection at front of engine.

Disconnect steering drag link rod from front steering arm.

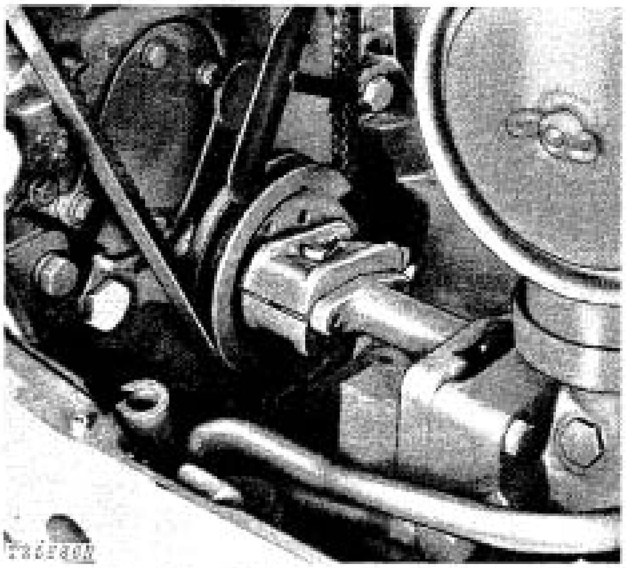


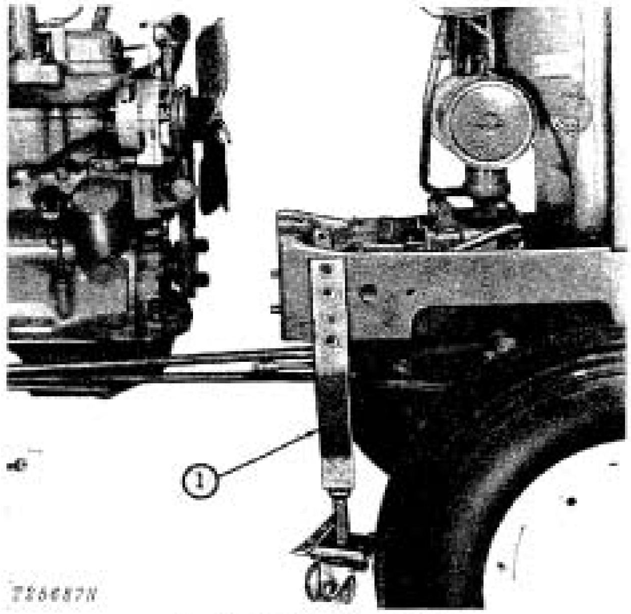
Fig. 5-Front End Support Attaching Points

Support rear of tractor under clutch housing. Insert wooden blocks between front axle and front end support to keep front end from tipping.

Install JDG-2K tractor splitting stand under front end as shown in Fig. 6. Modify the stand by slotting one hole in each side so that two screws can be installed on each side of support.

Remove attaching cap screws from front end support (Fig. 5). Roll front end away from engine as shown in Fig. 6.

CAUTION: Use caution to prevent front assembly from tipping forward. If fuel tank contains much fuel, either drain it or block front end. Also remove any front weights.



1—JDG-2K Splitting Stand

Fig. 6-Separating Front End Assembly

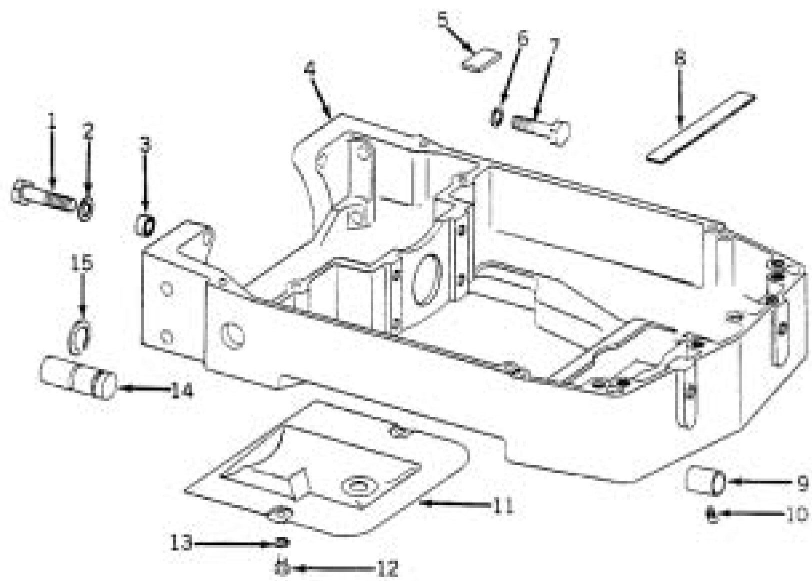
Attach chain hoist to front of front end support.

CAUTION: Place floor jack under the axle assembly during removal.

Remove cotter pin, slotted hex nut, washers, shim pack, and special cap screw from axle assembly. Slide axle assembly out from under front end assembly.

Remove the remaining components from the front end support.

REPAIR



T31887N

1—Cap Screw (2 used)	5—Baffle	9—Bushing	13—Lock Washer (2 used)
2—Lock Washer (2 used)	6—Lock Washer (4 used)	10—Grease Fitting	14—Rear Pivot Pin
3—Hollow Dowel (2 used)	7—Cap Screw (4 used)	11—Bottom Cover	15—Snap Ring (2 used)
4—Front Support	8—Packing Strip (2 used)	12—Cap Screw (2 used)	

Fig. 7-Front End Support

Disassembly

Refer to Fig. 7 during disassembly.

Inspect all parts for excessive wear or damage. Repair or replace parts as necessary.

Assembly

Refer to Fig. 7 during assembly and note the following:

Press bushing into support so hole in bushing is in line with hole in bore.

Put snap ring on center groove of rear pivot pin and press into bore until snap ring rests against shoulder of bore. Install second snap ring.

Attach baffle (if used) and packing strips to the front support using a suitable adhesive.

INSTALLATION

Install components on front end support.

Install axle on front support. Secure axle with special cap screw, shim pack, washers, and slotted nut.

Adjust axle end play as instructed further on in this section.

Carefully roll front end toward engine (Fig. 6). Guide pump shaft into drive coupling. Be sure woodruff key is in place.

IMPORTANT: Position main pump inlet line and reservoir return line retainer between lines and against clutch housing before inserting lines into clutch housing. Also insert check valve assembly in main pump inlet line before installing line.

Secure front end support to engine block. Tighten four attaching cap screws (7, Fig. 7) and two attaching cap screws (2) to standard torque.

Tighten pump drive coupling set screw.

IMPORTANT: Do not secure drive shaft to coupling until front end support is secured to engine block.

Position fuel line near right side of engine block and install fuel transfer pump making sure line fits under and behind transfer pump to filter line. Connect line to pump. On diesel engines, also connect fuel return line to tank. Open fuel shut-off valve at bottom of fuel tank. Connect fuel gauge sending wire to unit on fuel tank.

Position fan shroud over fan blade and insert radiator in from left side of tractor as shown in Fig. 3. Secure to front end support with attaching cap screws. Connect water inlet and outlet hoses.

Connect return line at top of reservoir.

If tractor is equipped with a reverser, also connect cooler return line to bottom of cooler and connect cooler inlet to top of cooler.

Connect all bleed lines to fitting on hydraulic oil reservoir.

On tractors with power steering, connect power steering pressure line to connector at accumulator.

Secure oil lines with clamps to engine oil pan. See Fig. 4.

Connect air cleaner hose to air intake manifold (diesel) or to carburetor (gasoline).

Connect drag link to steering shaft arm. Tighten slotted nut to 55 lb-ft. [7.6 kg-m]. Advance nut to next slot and insert cotter pin.

Install side frames and tool box (if equipped). Install hood and grille screens.

IMPORTANT: Install front support end of side grille retaining spring with open end of hook facing front of tractor.

Fill radiator with clean soft water and add antifreeze or John Deere Summer Engine Coolant Conditioner.

Connect battery ground strap.

IMPORTANT: Batteries are NEGATIVE grounded only. Do not polarize the alternator as this will damage the electrical system.

Start engine and check fuel lines, hydraulic lines and radiator hoses for leaks.

ADJUSTABLE FRONT AXLE ASSEMBLY

GENERAL INFORMATION

The units are equipped with either fixed or adjustable front axles. Sweptback front axles give shorter turning radius for sharper turns in the field or in close quarters.

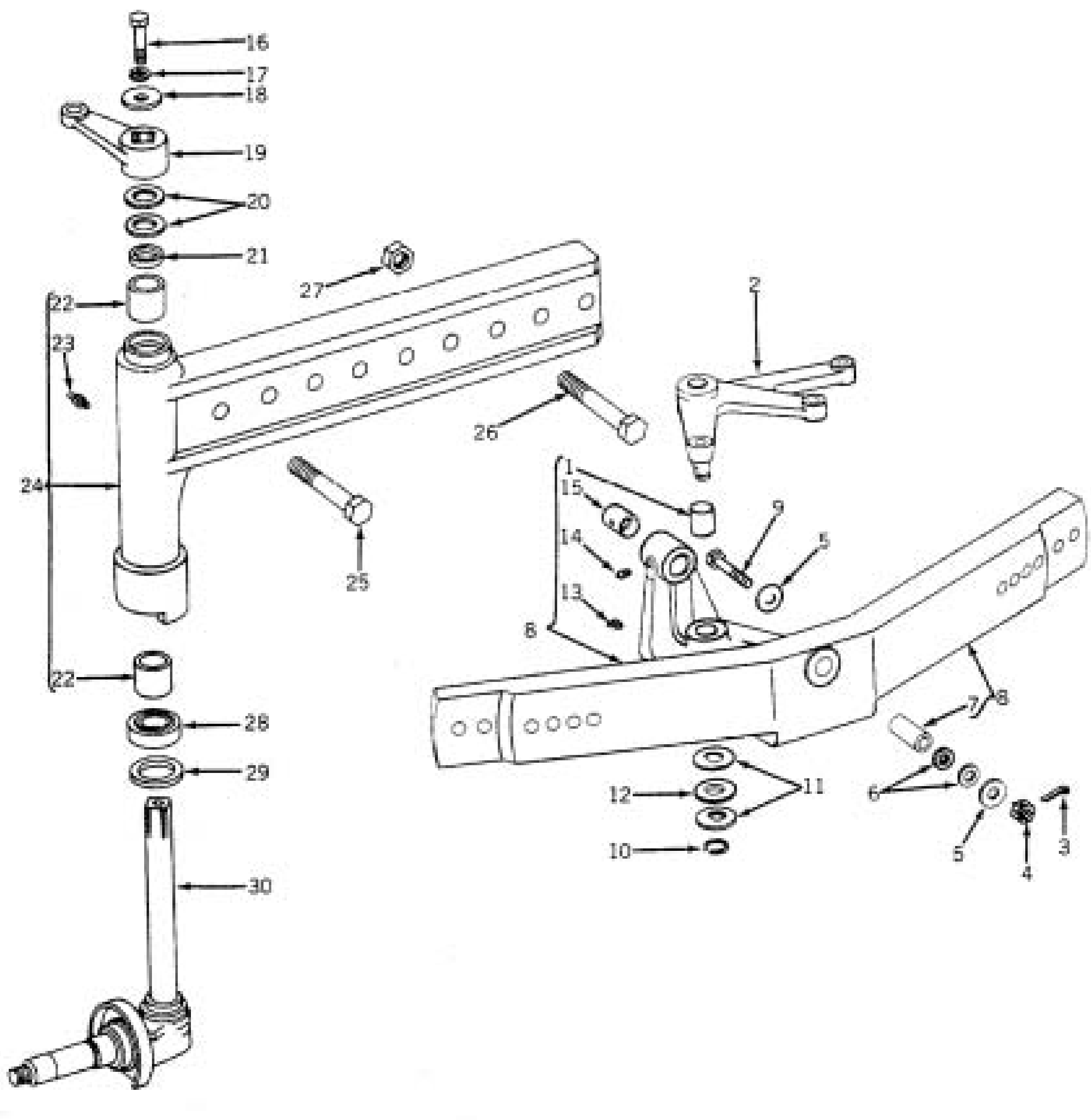
REMOVAL

Disconnect tie rods and drag link.

Support front end support with JDG-2K splitting stand.

Remove axle pivot cap screw and slide axle assembly toward the rear of the tractor until clear of front end support pivot pin. Pull front axle assembly out from under tractor.

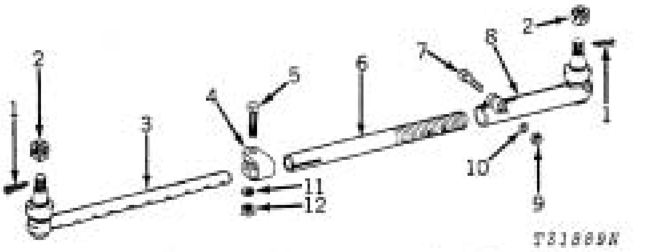
REPAIR



T31888N

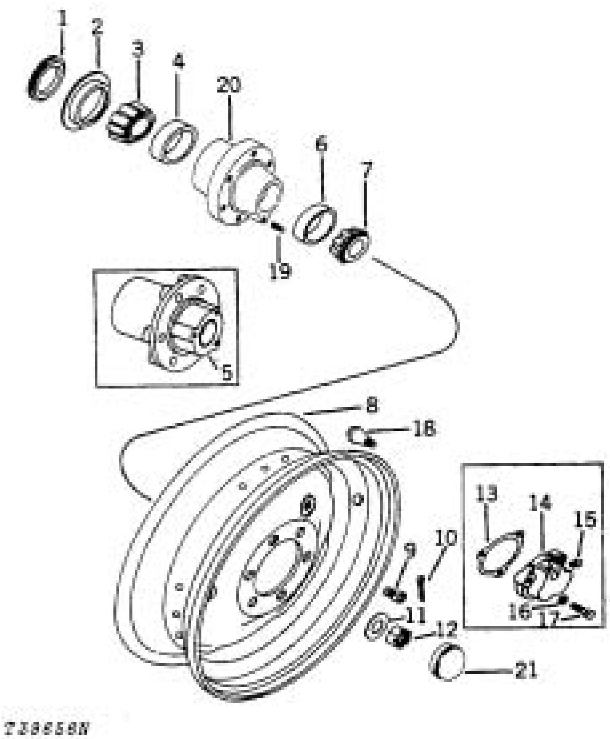
1—Bushing (2 used)
2—Bell Crank
3—Cotter Pin
4—Slotted Nut
5—Special Washer (2 used)
6—Shim (6 used)
7—Pivot Pin
8—Axle Assembly
9—Cap Screw
10—Snap Ring
11—Special Washer (2 used)
12—Shim (3 used)
13—Grease Fitting
14—Grease Fitting
15—Bushing
16—Cap Screw (2 used)
17—Lock Washer (2 used)
18—Special Washer (2 used)
19—Steering Arm (2 used)
20—Upper Shim (4 used)
21—Upper Seal (2 used)
22—Bushing (4 used)
23—Grease Fitting (2 used)
24—Knee Assembly (2 used)
25—Outer Cap Screw (4 used)
26—Inner Cap Screw (2 used)
27—Nut (6 used)
28—Thrust Bearing (2 used)
29—Seal (2 used)
30—Spindle and Knuckle Assembly (2 used)

Fig. 8-Adjustable Front Axle Assembly



1—Cotter Pin (2 used)
2—Slotted Nut (2 used)
3—Tie Rod End
4—Clamp
5—Cap Screw
6—Tube
7—Cap Screw
8—Tie Rod End
9—Nut
10—Lock Washer
11—Lock Washer
12—Nut

Fig. 9-Tie Rod Assembly (Adjustable Front Axle)



1—Oil Seal
2—Seal Cup
3—Inner Bearing
4—Inner Bearing Cup
5—Hub Assembly (-211797)
6—Outer Bearing Cup
7—Outer Bearing Cone
8—Wheel Rim
9—Hub Bolt (6 used)
10—Cotter Pin
11—Special Washer
12—Slotted Nut
13—Gasket (-211797)
14—Hub Cap (-211797)
15—Pipe Plug (-211797)
16—Washer (3 used) (-211797)
17—Cap Screw (3 used) (-211797)
18—Tire Valve
19—Pipe Plug (211798-)
20—Hub (211798-)
21—Hub Cap (211798-)

Fig. 10-Front Wheel Assembly (Heavy-Duty Axle)

Disassembly

Refer to Figs. 8, 9 and 10 during disassembly of the front axle, tie rod and front wheel assemblies.

Inspect all parts for wear or damage. Inspect seals for deterioration. Repair or replace parts as necessary.

Assembly

Press bellcrank pivot pin bushing into axle flush with bottom of chamfer on each end of bore with grease holes aligned.

Press axle rear pivot pin bushing into axle flush with bottom of chamfer with grease holes aligned.

Press front pivot pin into front axle flush with rear face of front pivot.

Install grease fitting (13, Fig. 8) into axle with inlet facing the right-hand side of axle.

Tighten knee-to-front axle cap screws (25 and 26) to standard torque.

Press knuckle spindle bushings into knee flush with bottom of chamfer.

Adjust vertical spindle end play by adding or removing shims under steering arms. Arms must turn freely, but end play must not exceed 0.030 inch [0.76 mm].

Lubricate bushings (14, 15 and 22 with John Deere Multi-Purpose Grease or an equivalent.

Tighten steering arm-to-spindle cap screw (16) to 170 lb-ft [23.5 kg-m]. Strike steering arm hub several times with a lead hammer and retighten.

Remove tie rod clamp screw (5, Fig. 9) and reinstall it so head end is to the front. Tighten to standard torque.

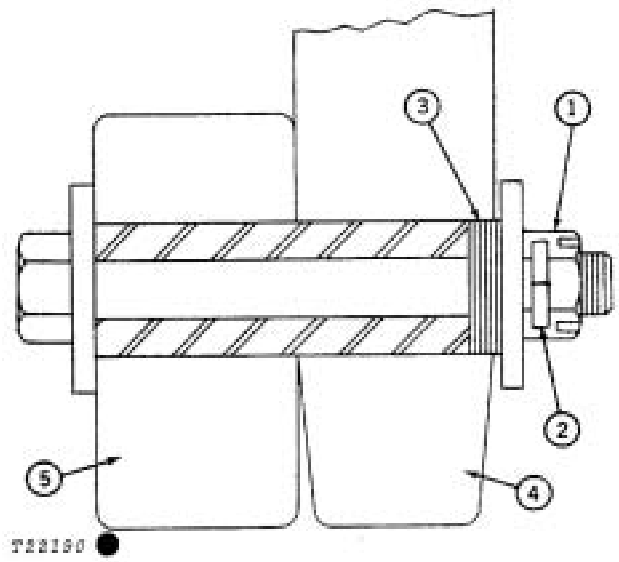
Install tie rods on steering bell crank and steering arms. Be sure that notched portion of tie rod is toward the outside of tractor. Tighten retaining nuts (2) to 55 lb-ft [7.60 kg-m].

Install bell crank on front axle. Bell crank must turn freely but clearance between bell crank and axle must not exceed 0.010 inch [.25 mm].

Install wheel and bearings on spindle and knuckle assembly. Tighten slotted nut to 35 lb-ft [5 kg-m]. Rotate wheel to align bearings and again tighten to 35 lb-ft [5 kg-m]. Back off nut to nearest slot and insert cotter pin.

NOTE: Back off nut even if slot aligns with hole after tightening.

INSTALLATION



1—Hex. Nut
2—Cotter Pin
3—Shim Pack
4—Front Support
5—Front Axle

Fig. 11-Front Axle Installed

Install axle on front support. Secure axle with special cap screw, shim pack, washers, and slotted nut (Fig. 11).

Add or subtract shims from shim pack to give specified end play of 0.000 to 0.015 inch [0.00 to .38 mm]

Tighten hex. nut to 220 lb-ft [30.42 kg-m] and advance to the next slot and insert cotter pin.

Install drag link on steering bell crank and steering arm and tighten to 55 lb-ft [7.6 kg-m]. Advance nut to nearest slot and insert cotter pin.

Install wheel (8, Fig. 10). Tighten hub bolts (9) to 100 lb-ft [136 Nm] [14 kg-m].

SOLID FRONT AXLE ASSEMBLY

GENERAL INFORMATION

The heavy-duty swept-back front axle mounts on the front end support. Swept-back axles give a shorter turning radius for sharper turns in close quarters.

REMOVAL

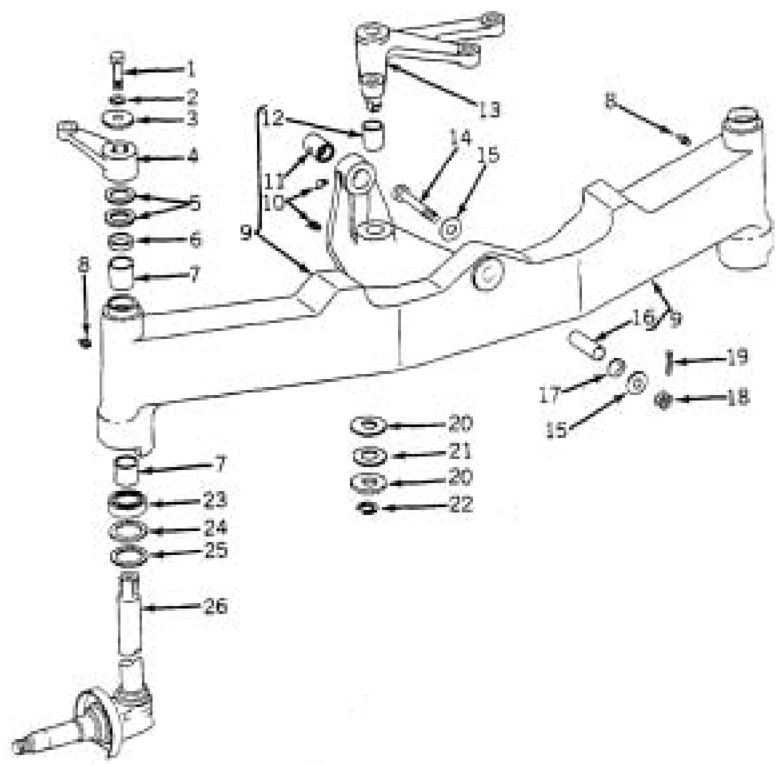
Place transmission in park position and attach hoist to tractor front end support.

Remove drag link from steering bell crank and steering shaft arm.

CAUTION: Place a floor jack under the axle assembly during removal.

Remove cotter pin, slotted hex. nut, washers, shim pack, and special cap screw from axle assembly. Slide axle assembly toward the rear until clear of support pivot pins.

REPAIR



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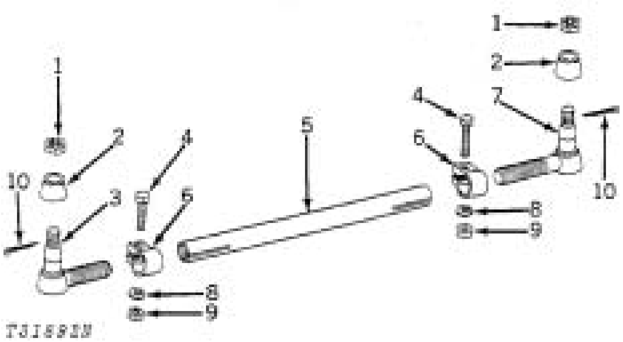
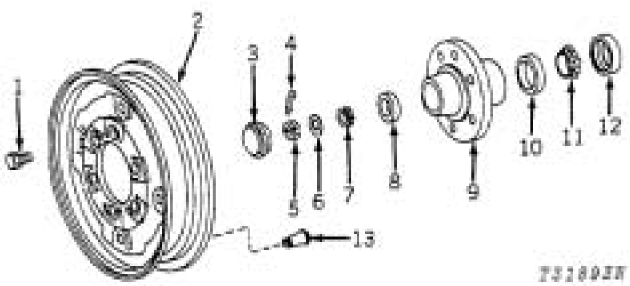
1—Cap Screw (2 used)
2—Lock Washer (2 used)
3—Special Washer (2 used)
4—Steering Arm
5—Shim (4 used)
6—Upper Seal (2 used)
7—Bushing (4 used)
8—Grease Fitting (2 used)
9—Axle Assembly
10—Grease Fitting (2 used)
11—Bushing
12—Bushing (2 used)
13—Bell Crank
14—Special Cap Screw
15—Special Washer (2 used)
16—Pivot Pin
17—Shim (5 used)
18—Slotted Nut
19—Cotter Pin
20—Special Washer (2 used)
21—Shim (3 used)
22—Snap Ring
23—Thrust Bearing (2 used)
24—Lower Seal (2 used)
25—Special Washer (2 used)
26—Spindle and Knuckle Assembly (2 used)

Fig. 12-Front Axle, Spindle and Knuckle Assembly



1—Slotted Nut (4 used)
2—Dust Cover (4 used)
3—Outer Tie Rod End (2 used)
4—Cap Screw (4 used)
5—Tube (2 used)
6—Clamp (4 used)
7—Inner Tie Rod End (2 used)
8—Lock Washer (4 used)
9—Nut (4 used)
10—Cotter Pin (4 used)

Fig. 13-Tie Rod Assembly (Solid Front Axle)



1—Special Bolt (6 used)
2—Front Wheel
3—Hub Cap
4—Cotter Pin
5—Slotted Nut
6—Special Washer
7—Outer Bearing Cone
8—Outer Bearing Cup
9—Hub
10—Inner Bearing Cup
11—Inner Bearing Cone
12—Oil Seal
13—Tire Valve

Fig. 14-Front Wheel Assembly (Regular Axle)

Disassembly

Refer to Figs. 12,13 and 14 during disassembly of the front axle, tie rods and front wheels.

Inspect all parts for wear or damage and repair or replace as necessary.

Assembly

Press axle front pivot pin into front axle flush with rear face of front pivot.

Press bell crank pivot pin bushing into axle flush with bottom of chamfer on each end of bore.

Press axle rear pivot pin bushing into axle flush with bottom of chamfer with grease holes lined up.

Press lower knuckle spindle bushings into knee flush with bottom of chamfer.

Press upper knuckle spindle bushings 0.31 inch [7.87 mm] below finished end of bore.

Install thrust bearing onto spindle shaft with numbered side of bearing away from knuckle.

Adjust vertical spindle end play by adding or removing shims under steering arms. Arms must turn freely, but end play must not exceed 0.030 inch [.76 mm].

Tighten steering arm attaching cap screw to 170 lb-ft [23.5 kg-m]. Strike steering arm hub several times with a lead hammer and retighten.

Install bell crank on the axle, and by adding or removing shims, adjust end play. Bell crank must turn freely but end play must not exceed 0.010 inch [0.254 mm].

Install wheel and bearings on spindle and knuckle assembly.

Tighten slotted nut to 35 lb-ft (5 kg-m) (Fig. 14). Rotate wheel to align bearings and again tighten to 35 lb-ft (5 kg-m). Back off nut to nearest slot and insert cotter pin.

NOTE: Back off nut even if slot aligns with hole after tightening.

INSTALLATION

Install axle on front support. Secure axle to front pivot pin with special cap screw, shim pack, washers, and slotted nut (Fig. 15).

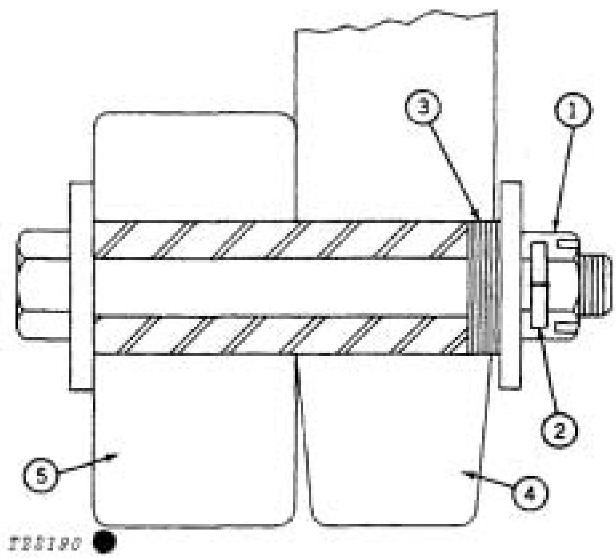
Add or subtract shims from shim pack to give specified end play of 0.000 to 0.015 inch (0.00 to 0.38 mm).

Tighten hex. nut to 220 lb-ft (30.42 kg-m) and advance to the next slot and insert cotter pin.

Install drag link on steering bell crank and steering arms, and tighten to 55 lb-ft (7.60 kg-m).

Advance nut to nearest slot and insert cotter pin.

Install wheel (2, Fig. 14). Tighten bolts (1) to 100 lb-ft (136 Nm) (14 kg-m).



1—Hex. Nut
2—Cotter Pin
3—Shim Pack
4—Front Support
5—Front Axle

Fig. 15-Front Axle Installed

Disassembly

Refer to Fig. 16 during disassembly.

Inspect steering shaft cover (3) for damage.

Check bushing (4) in cover for wear.

Assembly

Use JD 252 Driver to press bushing (4) flush with outer edge of bushing bore.

If necessary, press in new bushing at opposite end of steering and yoke shaft (left side of clutch housing in knockout plug opening). Bushing must be pressed flush to 0.03 inch [0.76 mm] below face of bore.

Install new oil seal (11) in left side of clutch housing with sealing lips facing bottom of oil seal bore chamfer. Use JD252 Driver for this installation.

Install plate (9) on yoke and tighten cap screw (7) to 8 lb-ft [1.11 kg-m].

INSTALLATION

Position steering shaft arm (12) in clutch housing and install steering shaft arm. Liberally grease splined end of steering shaft to prevent damage to steering shaft oil seal.

Loosely secure steering shaft arm to shaft with washer and cap screw. Install steering shaft cover. Tighten arm-to-shaft cap screw to standard torque. Strike arm with hammer and retighten.

Install drag link on steering bell crank and steering arm and tighten to 55 lb-ft [7.6 kg-m]. Advance nut to nearest slot and insert cotter pin.

Group 15
LOADER FRAME, BOOM AND BUCKET

GENERAL INFORMATION

The loader frame consists of a mast and boom assembly and is of welded steel construction.

The mast attaches to the mounting frame on the tractor with eight cap screws.

A bucket level indicator is located on the right hand bucket cylinder (see Operator's Manual).

Loader hydraulic functions are performed by two control levers.

The bucket cutting edge is made of high carbon steel.

REMOVAL

Stop engine and lower bucket to the ground. Operate levers to release hydraulic pressure from loader system.

Disconnect battery ground strap.

Disconnect loader pressure and return lines at the disconnect couplers. Plug fittings and lines to prevent dirt entry.

Attach a chain hoist to rear of loader boom.

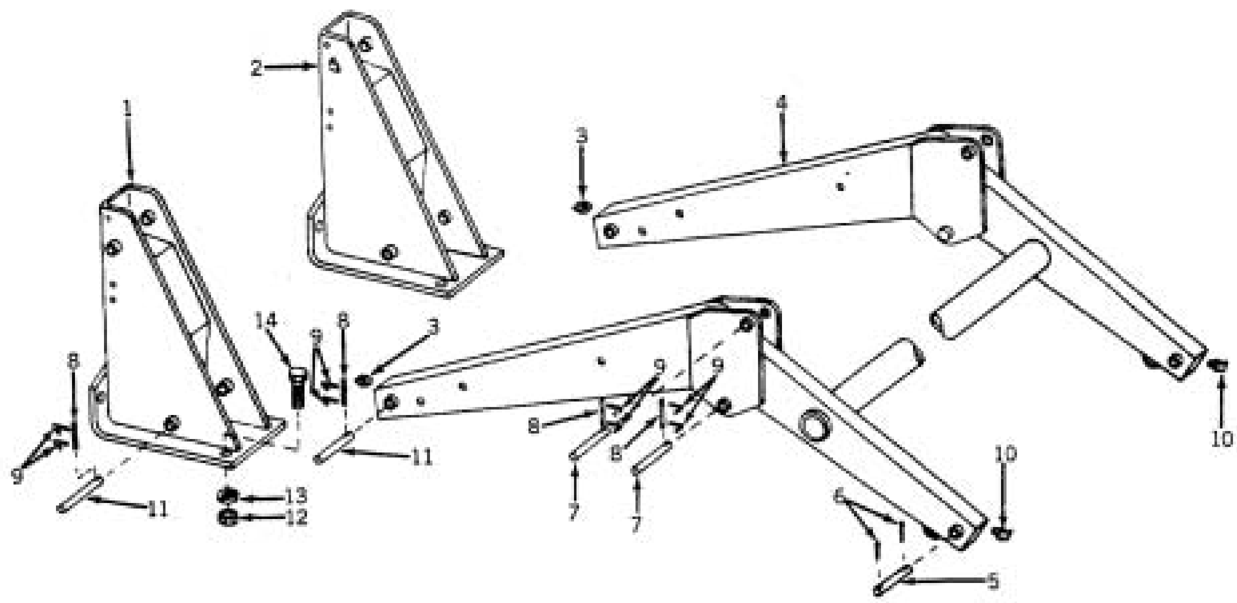
Remove cap screws securing mast to mounting frame.

With loader supported by chain hoist, back tractor away from loader.

Lower masts to the ground.

REPAIR

Mast and Boom



1—Right-Hand Mast
2—Left-Hand Mast
3—Grease Fitting (2 used)
4—Boom
5—Pin (2 used)
6—Cotter Pin (4 used)
7—Pin (4 used)
8—Drive Pin (8 used)
9—S-type Cotter (16 used)
10—Grease Fitting (2 used)
11—Pin (4 used)
12—Nut (8 used)
13—Lock Washer (8 used)
14—Cap Screw (8 used)

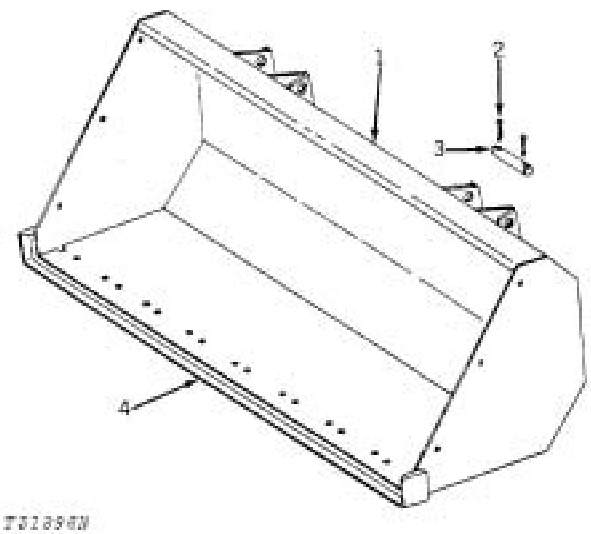
Fig. 1-Mast and Boom

Refer to Fig. 1 when disassembling and assembling mast and boom.

Inspect all parts for excessive wear or damage and repair or replace as necessary.

Grease fittings (3 and 10) after assembly.

Bucket



1—Bucket
2—Cotter Pin (4 used)
3—Pin (2 used)
4—Bucket Cutting Edge

Fig. 2-Bucket

Refer to Fig. 2 during disassembly and assembly of bucket parts.

Inspect all parts for excessive wear or damage and repair or replace as necessary.

IMPORTANT: Because bucket cutting edges are made of high carbon steel, special welding techniques are required.

SPECIAL WELDING INSTRUCTIONS

A low hydrogen (with iron powder) electrode (American Welding Society, Series E7018) is recommended for this type of work. The sizes most easily handled in horizontal or out of flat positions are 5/32-inch [3.96 mm] and 3/16-inch [4.76 mm] diameters.

To obtain maximum strength it is imperative that all craters at the termination of each weld be filled. Because of the cupping action of heavy electrode coating it is necessary to drag the electrode lightly or hold a very short arc.

As a second choice, an E7010 Series Electrode can be used in DC reverse polarity after preheating the cutting edge to approximately 300 degrees F. [148.9 degrees C.]. Allow the edge to cool slowly.

IMPORTANT: When repairing a small section of the cutting edge, it is necessary to preheat around damaged area regardless of the electrode used. This will prevent rapid cooling of the edge around the weld which could cause the cutting edge to become brittle.

When cutting edge is cracked, cut completely through cutting edge, extend cut 1/2-inch [12.7 mm] beyond each end of crack.

Weld crack from both sides.

When welding cracks between cutting edge and bucket, extend weld at least 1/2-inch [12.7 mm] beyond each end of the crack.

INSTALLATION

Attach a chain hoist to rear of boom. Raise boom.

Carefully drive tractor into loader, aligning the mast with mounting frames on tractor.

Remove chain hoist. Attach loader to mounting frames. Tighten cap screws to standard torque.

Connect hydraulic lines at disconnect couplers.

Group 20
3-POINT HITCH

GENERAL INFORMATION

1—Link End
2—Ball (2 used)
3—Pin (2 used)
4—Pin (2 used)
5—Handle
6—Quik Lock Pin
7—Category 1 Bushing
8—Pin (Category 2)
9—Link End
10—Link Body
11—Pin
12—Cap Screw (2 used)
13—Nut (4 used)
14—R.H. Washer
15—Leveling Shaft
16—Leveling Ball
17—Ball Housing
18—Handle Shaft
19—Spring Pin
20—Leveling Handle
21—O-Ring
22—Bushing
23—Needle Bearing
24—Strap
25—Link Body (2 used)
26—Pin (2 used)
27—Plate (4 used)
28—Quik Lock Pin (2 used)
29—Category 1 Bushing (2 used)
30—Draft Link (2 used)
31—Lock Washer (3 used)
32—Cap Screw (3 used)
33—Cotter Pin (2 used)
34—Pin (2 used)
35—Center Link Bracket
36—Center Link End
37—Thrust Race (2 used)
38—Grease Fitting (3 used)
39—Spring Pin
40—Retaining Ring (2 used)
41—Washer (2 used)
42—Washer (2 used)
43—Spring (2 used)
44—Washer (2 used)
45—Lock Pin (2 used)
46—R.H. Draft Tube
47—Draft Link Bar (2 used)
48—L.H. Draft Tube
49—Retainer (2 used)
50—Cotter Pin (2 used)

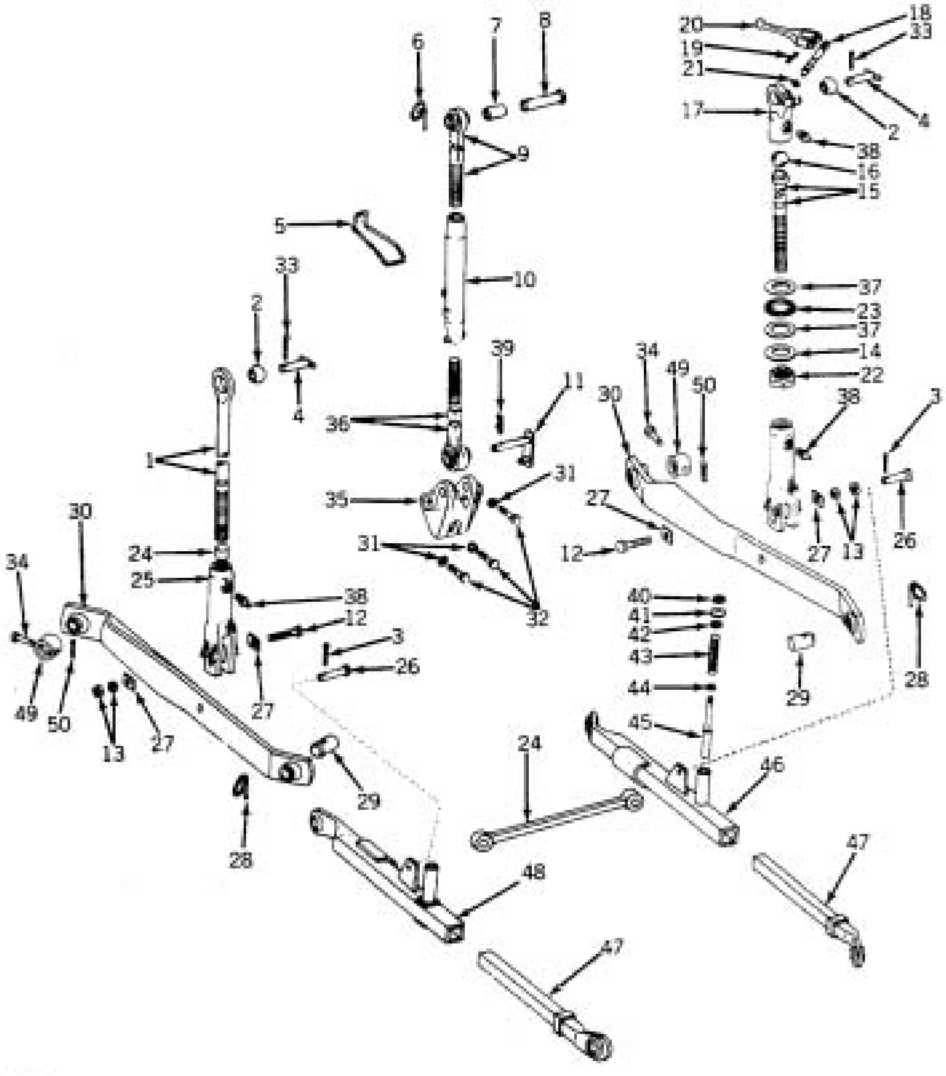


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Fig. 1-3-Point Hitch with Telescoping Draft Links

The 3-point hitch, operated by the rockshaft, provides a method of attaching a complete line of rear-mounted equipment. The hitch and mounted equipment are controlled by the rockshaft control lever.

The 3-point hitch is basically a category 2 hitch, but is adaptable to category 1 implements by installing adapter bushings on the draft links and a pin and bushing in the center link.

REMOVAL

Refer to Fig. 1 for removal of the 3-point hitch from the unit. Remove pins (34, 4, 11) from the five attaching points. Lift hitch from the unit.

REPAIR

Refer to Fig. 1 for disassembly and assembly. Inspect parts for excessive wear and replace as necessary.

INSTALLATION

Install 3-point hitch by reversing removal procedure.

Group 25
SPECIFICATIONS AND SPECIAL TOOLS
MANUAL STEERING
SPECIFICATIONS AND TORQUE VALUES

Fig. 1-Steering Gear

1 - Steering wheel hex. nut..........................50 lb-ft. [6.91 kg-m]

2 - Adjuster jam nut......................................75 lb-ft. [10.37 kg-m]

3 - Lateral pull required to move yoke and shaft side to side..........15 to 17 lbs. [6.80 to 7.71 kg]

SPECIAL TOOLS

Essential Tools

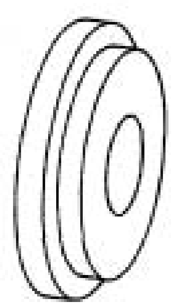


Fig. 2-JD252

Tool Number	Use
JD252	To install seal in clutch housing.

ADJUSTABLE FRONT AXLE ASSEMBLY

SPECIFICATIONS AND TORQUE VALUES

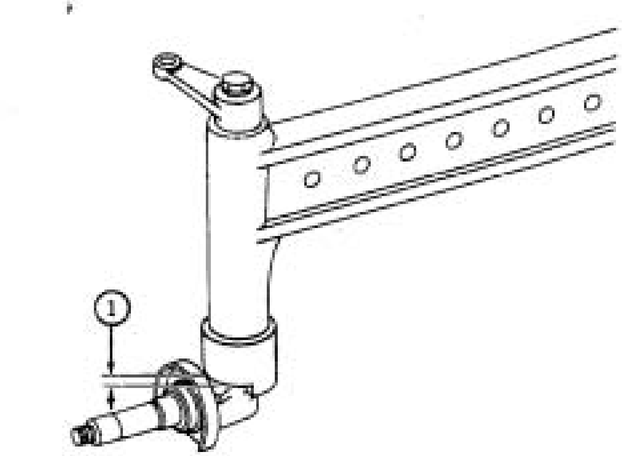


Fig. 3-Adjustable Axle End Play

1 - Vertical spindle end play .... 0.030 in. max. [0.76 mm]

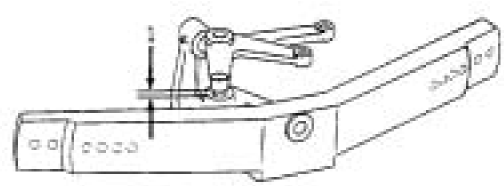


Fig. 4-Bell Crank End Play

1 - Bell crank end play .... 0.010 in. max. [.254 mm]

ADJUSTABLE FRONT AXLE ASSEMBLY
SPECIFICATIONS AND TORQUE VALUES—Continued

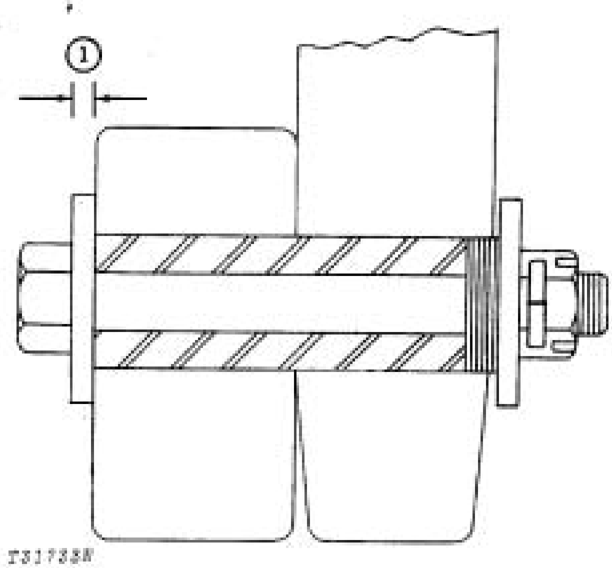


Fig. 5-Axle Pivot End Play

1 - Axle pivot end play................0.000 to 0.015 in. [0.00 to 0.38 mm]

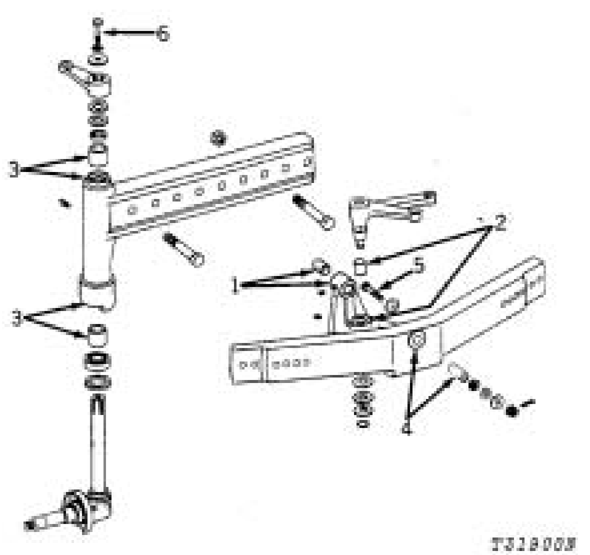


Fig. 6-Adjustable Front Axle End Plays

1 - Axle rear pivot pin bushing................Press into axle flush with bottom of chamfer with grease holes lined up.

2 - Bell crank pivot pin bushing...............Press into axle flush with bottom of chamfer on each end of bore with grease holes lined up.

3 - Knuckle spindle bushings ....Press into knee flush with bottom of chamfer.

4 - Axle front pivot pin.....................Press into front axle flush with rear face of front pivot.

5 - Axle-to-front support cap screw...........220 lb-ft. [30.42 kg-m]

6 - Steering arm-to-spindle and knuckle cap screw ....170 lb-ft. [23.50 kg-m]

ADJUSTABLE FRONT AXLE ASSEMBLY

SPECIFICATIONS AND TORQUE VALUES—Continued

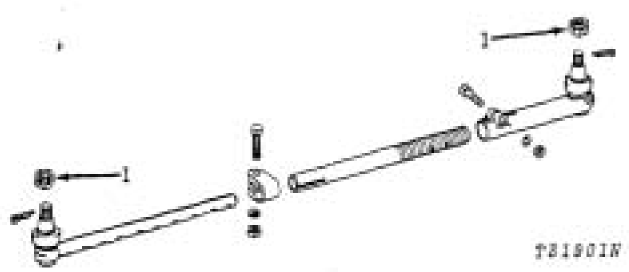


Fig. 7-Tie Rod (Adjustable Axle)

1 - Tie rods-to-steering arms and bell crank slotted nuts .... 55 lb-ft (7.60 kg-m)

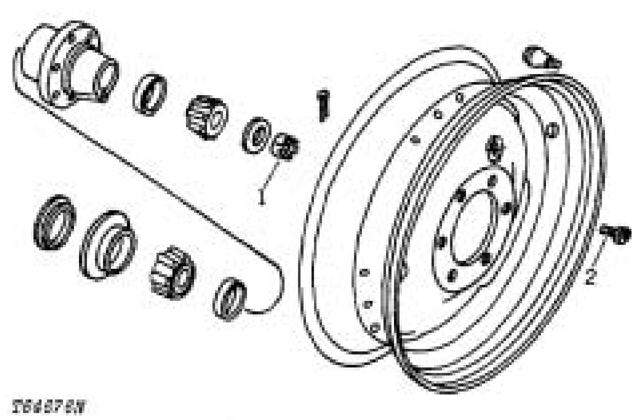


Fig. 8-Front Wheel (Heavy-Duty Illustrated)

1 - Wheel-to-knuckle slotted nut .... 35 lb-ft (47 Nm) (5 kg-m)

Back nut off to nearest slot.

2 - Hub bolt torque .... 100 lb-ft (136 Nm) (14 kg-m)

SOLID FRONT AXLE ASSEMBLY

SPECIFICATIONS AND TORQUE VALUES

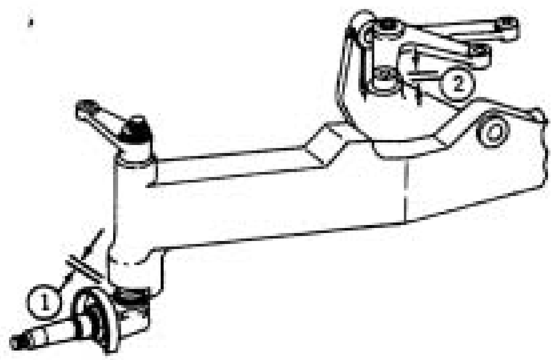


Fig. 9-Front Axle Assembly End Play

1 - Vertical spindle end play .... 0.030 in. max. (0.76 mm)

2 - Bell crank end play .... 0.010 in. max. (0.254 mm)

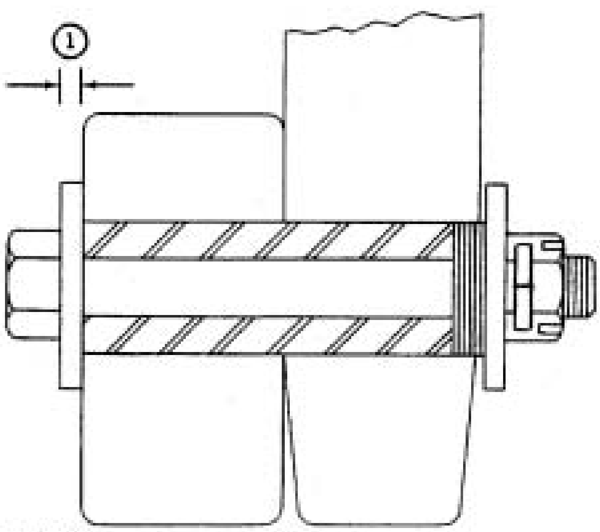


Fig. 10-Front Axle End Play

1 - Axle pivot end play .... 0.000 to 0.015 in. (0.00 to 0.38 mm)

SOLID FRONT AXLE ASSEMBLY

SPECIFICATIONS AND TORQUE VALUES—Continued

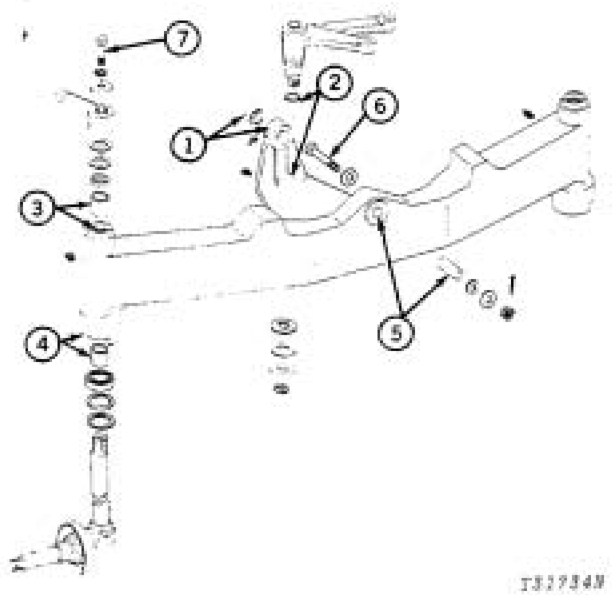


Fig. 11-Front Axle Assembly

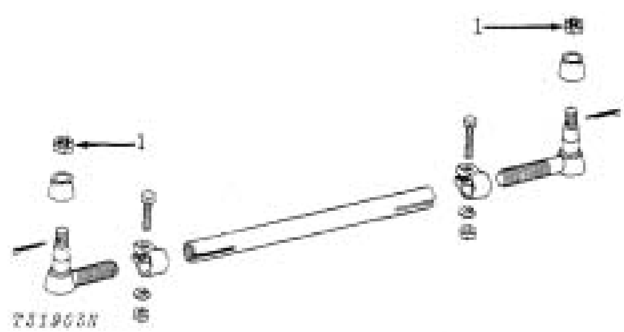


Fig. 12-Tie Rod (Solid Front Axle)

1 - Axle rear pivot pin bushing................Press into axle flush with bottom of chamfer with grease holes lined up.

2 - Bell crank pivot pin bushing...............Press into axle flush with bottom of chamfer on each end of bore.

3 - Upper knuckle spindle bushing.........Press 0.31 in. [7.87 mm] below finished end of bore.

4 - Lower knuckle spindle bushing..........Press into knee flush with bottom of chamfer.

5 - Axle front pivot pin.....................Press into front axle flush with rear face of front pivot.

6 - Axle-to-front support cap screw...........220 lb-ft. [30.42 kg-m]

7 - Steering arm-to-spindle and knuckle cap screw..170 lb-ft. [23.50 kg-m]

1 - Tie rods-to-steering arms and bell crank slotted nuts...55 lb-ft. [7.60 kg-m]

SOLID FRONT AXLE ASSEMBLY

SPECIFICATIONS AND TORQUE VALUES—Continued

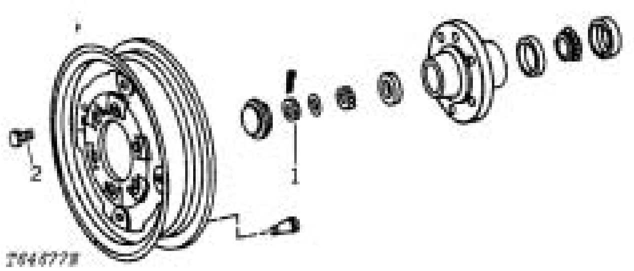


Fig. 13-Front Wheel (Regular Illustrated)

1 - Wheel-to-knuckle slotted nut........... 35 lb-ft (47 Nm) (5 kg-m)

Back nut off to nearest slot.

2 - Hub bolt torque .... 100 lb-ft (136 Nm) (14 kg-m)

SPECIAL TOOLS

FRONT END ASSEMBLY

Essential Tools

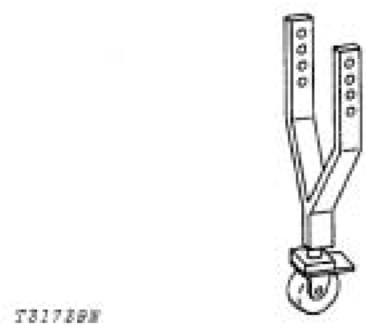


Fig. 14-Splitting Stand

Tool Number	Use
JDG-2K	Splitting Stand - Remove front end support and adjustable front axle assemblies.

Section 70
SYSTEM TESTING

CONTENTS OF THIS SECTION

Group 5
GENERAL INFORMATION

SEVEN BASIC STEPS OF DIAGNOSIS AND TESTING

To prevent the unnecessary loss of time and money, use the following seven steps for a quick and accurate method of locating troubles:

1. Know The Unit

In other words, "Do your Homework." Study this manual to know how the individual components work and what their function is in the over-all system.

Keep up with the latest service information. Read and then file in a handy place. Information received today may have the cause and remedy of a problem being encountered.

2. Ask The Operator

Question the operator as to how the unit acted when it started to fail. Find out what was unusual about it.

Also find out if any do-it-yourself service was performed. (You may find out later that the trouble is somewnere else, but you should know if any components were tampered with.)

Ask how the unit is used and when it is serviced. Many problems can be traced to poor maintenance or abuse.

3. Operate The Unit

Get on the unit and operate it. Warm it up and put it through its paces. Don't completely rely on the operator's story - check it yourself.

Are the gauges reading normal? (If not, it may be that the component being monitored is not functioning correctly or it may mean that the gauge is faulty.

How's the performance? Is the action slow, erratic, or nil?

Do the controls feel solid or "spongy"? Do they seem to be "sticking"?

Smell anything? Any signs of smoke?

Hearing any funny sounds? Where? At what speeds or during what cycles?

4. Inspect The Unit

Get off the unit and make a visual check. Use your eyes, ears, and nose to spot any signs of trouble.

Look closely at the components. Inspect for cracked welds, loose tie bolts, damaged linkages, worn or broken lines, etc.

During the inspection, make a note of all the trouble signs.

5. List The Possible Causes

With the information obtained during steps 1 through 4, make a list of the possible causes.

What were the signs you found while inspecting the unit? What is the most likely cause?

6. Reach A Conclusion

Look over the list of possible causes and decide which are most likely and which are easiest to verify.

"Diagnosing Malfunctions" given in the following groups will be a helpful guide.

Reach your decision on the leading causes and plan to check them first.

7. Test Your Conclusion

Before repairing components in the system, test your conclusions to make sure they are correct.

Some of the possible causes can be verified without further testing. Check these possibilities first.

Tests will soon narrow the remaining list of possible causes and soon the actual source of trouble will be pinpointed.

With the trouble accurately located, it is now a simple matter to remove and repair the component at fault.

Group 10
ENGINE

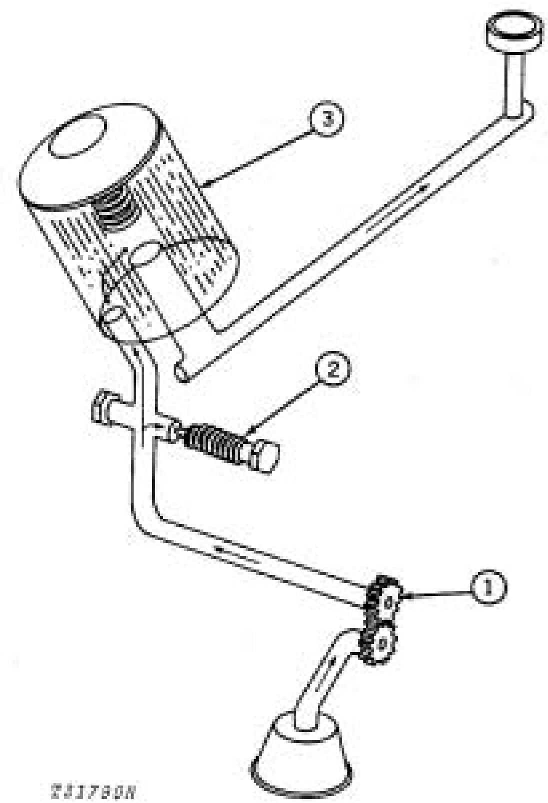
GENERAL INFORMATION

Basic Engine

The JD302 Tractor and Loader has either a 3 cylinder 164 cubic inch [2667.5 cm^3] gasoline engine or a 3 cylinder 164 cubic inch [2667.5 cm^3] diesel engine.

Both engines are valve-in-head vertical in-line four cycle engines. Both engines consist of a lubrication system, cooling system, fuel system and air intake system.

Engine Lubrication System



1—Oil Pump
2—Pressure Regulating Valve
3—Oil Filter

Fig. 1-Engine Lubrication System

The components of the lubrication system are the oil filter and a gear driven positive displacement oil pump and an engine oil pressure regulating valve (Fig. 1).

The oil pump draws lubricant from the oil pan through a system of gears and sends it through an internal passage to the engine oil filter.

The oil filter is a spin-on replaceable element. It removes contaminants from the engine oil. From the filter the oil goes through the main gallery to the oil pressure regulating valve.

The oil pressure regulating valve is used to maintain and regulate engine oil pressure.

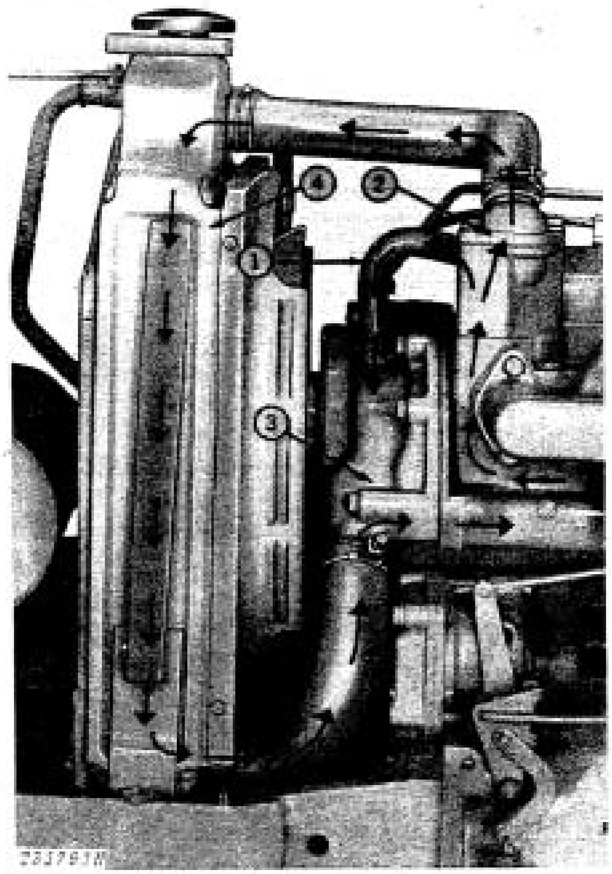
After oil flows past the regulating valve it flows into oil gallerys and is dispensed to lubricate the internal moving parts of the engine.

Engine Cooling System

The components of the cooling system are the radiator, water pump and fan, and thermostat and housing (Fig. 2).

The radiator is equipped with a pressure cap which acts as a relief valve to keep pressure at a specified level in the system.

The water pump draws coolant from the radiator and sends it into the main coolant gallery. Coolant from the gallery circulates through the engine to cool the block, cylinder liners, and head and then flows into the water manifold into the thermostat housing.



1—Bypass Line
2—Thermostat Housing
3—Water Pump
4—Radiator

Fig. 2-Cooling System

If the thermostats are closed (as during engine warm-up) the coolant is sent directly to the water pump for recirculation and bypasses the radiator. This allows a faster and more uniform warm-up.

Fuel System

Diesel

The components of the diesel fuel system are the fuel tank, fuel supply pump, the fuel filter, the fuel injection pump and the fuel injection nozzles.

The fuel tank has a small finger-shaped filter and a fuel shut-off valve located in the bottom of the tank.

The fuel supply pump operates off a cam lobe of the camshaft. It draws fuel from the tank and delivers it to the fuel injection pump through the fuel filter.

The filter removes impurities from the fuel before it enters the injection pump.

The injection pump pressurizes the fuel and sends it through high-pressure lines to the injection nozzles.

The injection nozzles open when the fuel reaches a specified level and inject the fuel into the combustion chambers.

Gasoline

The components of the gasoline fuel system are the fuel tank, the fuel supply pump, the fuel filter, the carburetor and the governor.

The fuel supply pump draws fuel from the tank and delivers it to the carburetor through the fuel filter.

The fuel filter removes impurities from the gasoline before it enters the carburetor.

The carburetor breaks up the fuel into a spray and combines it with air from the air cleaner. The fuel air mixture goes into the intake manifold into the combustion chamber.

The carburetor is regulated by the governor. The governor uses a system weights and linkages to control the amount of fuel and air supplied to the engine.

Air Intake System

The components of the air intake system are the air cleaner and the intake manifold.

Air enters the air cleaner. The two air cleaner elements remove impurities from the ambient air.

On diesel units the air then enters the intake manifold which delivers it to the combustion chambers.

On gasoline engines the filtered air enters the carburetor where it is combined with vaporized gasoline before it enters the intake manifold.

Speed Control Linkage

The speed control linkage consist of the hand and foot throttles and various linkages which are connected to the governor on gasoline engines and the injection pump on diesel engines. Through common movement of the throttles and linkages speed control is maintained.

DIAGNOSING MALFUNCTIONS

Engine Will Not Start or Starting Hard

Fuel System Malfunction
- Fuel Tank empty
- Improper type of fuel
- Foreign material in fuel
- Fuel lines clogged or restricted
- Air leak on suction side of fuel system
- Fuel transfer pump malfunction
- Fuel filter restricted (diesel)
- Restricted air intake system
- Faulty injection pump (diesel)
- Faulty injection nozzles (diesel)
- Water, dirt, or air in fuel system
- Carburetor malfunction (gasoline)

Electrical System Malfunction
- Corroded or loose battery cables
- Weak or dead battery
- Cranking speed too slow

Uneven Running or Frequent Stalling

Basic Engine Malfunction
- Improper valve clearance
- Cylinder head gasket leaking
- Valves sticking or burned
- Worn or broken compression rings
- Low compression
- Incorrect timing
- Dirty air intake system
- Exhaust system restricted
- Engine overheating

Fuel System Malfunction
- Improper type of fuel
- Air leak on suction side of fuel system
- Fuel line clogged or restricted
- Fuel transfer pump malfunction
- Fuel filter restricted (diesel)
- Faulty injection pump (diesel)
- Faulty injection nozzles (diesel)
- Water, dirt, or air in fuel system
- Injection nozzle leak-off lines clogged (diesel)
- Injection pump or distributor out of time
- Exhaust system restricted
- Improper carburetor setting (gasoline)

Engine Misses

Basic Engine Malfunction
- Weak valve springs
- Incorrect valve clearance
- Burned, warped, pitted or sticking valves
- Low compression
- Worn camshaft lobes
- Engine overheating

Fuel System Malfunction
- Water, air or dirt in fuel
- Faulty injection nozzles (diesel)
- Faulty injection pump (diesel)
- Faulty transfer pump
- Detonation
- Mixture of gasoline and diesel fuels
- Carburetor out of adjustment (gasoline)

Lack of power

Basic Engine Malfunction
- Blown cylinder head gasket
- Worn camshaft lobes
- Incorrect valve clearance
- Incorrect valve timing
- Burned, warped, pitted, or sticking valves
- Weak valve springs
- Low compression
- Dirty air intake system
- Incorrect timing
- Engine overheating

Fuel System Malfunction
- Improper type of fuel
- Air leak on suction side of fuel system
- Fuel line clogged or restricted
- Fuel transfer pump malfunction
- Speed control linkage not adjusted properly
- Fuel filter restricted (diesel)
- Fuel injection pump malfunction (diesel)
- Fuel injection nozzle faulty (diesel)
- Water, dirt or air in fuel system
- Injection nozzle leak-off line clogged (diesel)
- Injection pump or distributor out of time
- Clogged manifold system
- Carburetor adjusted too lean (gasoline)

Black or Gray Exhaust Smoke (Diesel)

Basic Engine Malfunction
- Incorrect engine timing
- Engine overloaded
- Restricted air cleaner
- Defective muffler
- Dirty air intake system

Fuel System Malfunction
- Improper grade of fuel
- Excessive fuel delivery
- Faulty injection nozzles (diesel)
- Injection nozzle leak-off line clogged (diesel)
- Injection pump out of time (diesel)

White Exhaust Smoke

Basic Engine Malfunction
- Low compression

Fuel System Malfunction
- Faulty injection nozzle (diesel)
- Improper fuel
- Injection pump out of time (diesel)
- Improper carburetor adjustment (gasoline)

Slow Acceleration

Fuel System Malfunction
- Faulty injection nozzle (diesel)
- Improper fuel
- Faulty carburetor (gasoline)

Engine Backfires

Fuel System Malfunction
- Faulty carburetor (gasoline)

Electrical System Malfunction
- Faulty ignition system

Detonation

Fuel System Malfunction
- Injection pump out of time (diesel)
- Faulty injection nozzles (diesel)

Abnormal Engine Noise

Basic Engine Malfunction
- Excessive valve clearance
- Worn cam followers
- Bent push rods
- Worn rocker arm shafts
- Worn main or connecting rod bearings
- Foreign material in combustion chamber
- Worn piston pin bushings and pins
- Scored piston
- Incorrect engine timing
- Excessive crankshaft endplay
- Loose main bearing caps
- Worn timing gears
- Worn oil pump gears
- Broken oil pump shaft
- Low engine oil level
- Camshaft oil pump gear worn or broken
- Gears worn or broken

Excessive Oil Consumption

Basic Engine Malfunction
- Restricted crankcase breather
- Worn valve guides or valve stems
- Piston rings worn or broken
- Scored liners or pistons
- Excessive ring groove wear in piston
- Rings sticking in grooves of piston
- Oil return slots in piston clogged
- Insufficient piston ring tension
- Piston ring gaps not staggered
- Excessive main or connecting rod bearing clearance
- Worn crankshaft thrust bearing (misaligned piston and rod)
- Front or rear crankshaft seal faulty
- Crankcase oil too thin (wrong viscosity)
- Oil level too high
- Restricted air intake system

Low Oil Pressure

Basic Engine Problem
- Excessive main and connecting rod bearing clearance
- Low oil level
- Leakage at internal oil passages
- Faulty oil pump
- Improper regulating valve adjustment
- Improper oil (wrong viscosity)
- Defective oil pressure indicator light

High Oil Pressure

Basic Engine Problem
- Stuck regulating valve
- Regulating valve spring worn or broken

Engine Overheats

Basic Engine Malfunction
- Defective head gasket
- Incorrect engine timing
- Low coolant level
- Radiator dirty or plugged
- Loose or broken fan belt
- Faulty thermostats
- Cooling system limed up
- Defective radiator pressure cap
- Faulty water pump
- Scored piston
- Air in coolant
- Engine overloaded
- Crankcase oil level low

Fuel System Malfunction
- Improper fuel
- Excessive fuel delivery
- Improper injection pump timing (diesel)
- Carburetor faulty (gasoline)

Water Pump Leaks

Basic Engine Malfunction
- Worn seal and/or shaft in water pump
- Worn or broken water pump gasket
- Water pump damaged
- Water pump impeller broken

Engine Runs Cold

Basic Engine Problem
- Faulty thermostats
- Defective temperature gauge

Water Pump Making Noise

Basic Engine Malfunction
- Worn water pump shaft
- Water pump impeller broken
- Bent or broken fan blade
- Loose fan belt
- Fan hitting

Oil in Coolant or Coolant in Crankcase

Basic Engine Malfunction
- Leaking head gasket
- Cylinder liner packings leaking
- Cylinder block water jacket cracked
- Cylinder liner cracked

VISUAL INSPECTION

By visually inspecting the engine before you tune it, you can learn a lot about its general condition.

For example, if the engine has been using too much oil, this often means an external oil leak. If the engine overheats, look for leaks in the cooling system.

Oil and Water Leakage

Look for water leaks at the radiator, water pump, hoses around cylinder head gasket and water manifold.

Check coolant for proper level and examine visible portion inside top of radiator for evidence of rust or scale.

Check crankcase oil level and for coolant in oil.

Look for oil leaks at the oil pan, drain plugs and gaskets.

Hoses

Inspect upper and lower radiator hoses and by-pass hose for hardening or cracking, and softening and swelling. Examine hoses at least twice a year for possible replacement and tightening.

Radiator

Inspect the radiator for bent fins, kinks, dents, fractured seams, and tubes for cracks.

Fan

The only service on the fan is to be certain the fan blades are straight and are far enough from the radiator so they do not strike the core.

Bent blades reduce the efficiency of the cooling system and throw the fan out of balance.

Fan Belt

The fan belt should be neither too tight nor too loose.

A belt which is too tight puts extra load on the fan bearings and shortens the life of the bearings as well as the belt.

A belt which is too loose allows slippage and lowers the fan speed, causes excessive belt wear and leads to overheating of the cooling system.

The condition of the belts and their tension should be checked periodically. Adjust fan belt tension as shown in "Testing and Adjustments" in this group.

Fuel Tank

Check all seams and connections for fuel leakage.

Fuel Filter (Diesel)

Check all connections. Check sediment bowl daily for deposits and drain if necessary. Replace filter elements as required.

Fuel Supply Pump

Check fuel inlet and outlet connections for leaking fuel.

On diesel engines be sure the primer level is in its farthest downward position.

Fuel Injection Pump (Diesel)

CAUTION: Escaping diesel fuel under pressure can have sufficient force to penetrate the skin causing serious personal injury.

Fuel escaping from a very small opening can be almost invisible. Use a piece of cardboard or wood, rather than a hand, to hold near connections to check for fuel leaks.

If injured by escaping fuel, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered at once.

Check fuel inlet and outlet connections and high pressure fuel supply connections. If any of the lines are twisted, kinked or broken, repair or replace as necessary.

Fuel Injection Nozzles (Diesel)

CAUTION: Escaping diesel fuel under pressure can have sufficient force to penetrate the skin causing serious personal injury.

Fuel escaping from a very small opening can be almost invisible. Use a piece of cardboard or wood, rather than a hand, to hold near connections to check for fuel leaks.

If injured by escaping fuel, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered at once.

Check each delivery and leak-off line. Repair or replace lines if necessary.

Carburetor (Gasoline)

Check fuel line into carburetor for leaks. Check air inlet for tight seal.

Carburetor to intake manifold connection must be tight.

Governor

Check governor linkage for loose, twisted or bent conditions.

Air Cleaner

Check all air intake and outlet connections to be sure they are tight. Check level of dirt in pre-cleaner and empty if necessary. Check air restriction indicator daily. Clean element when indicator shows red with engine shut off, or when excessive smoke or loss of power is noted.

Replace air cleaner elements every 1000 hours.

Manifolds

Check all connections and gaskets.

TESTING AND ADJUSTMENT

Basic Engine

Compression Pressure Test

1 - Clean the engine thoroughly, preferably by steam cleaning.

2 - Warm the engine to operating temperature.

3 - When engine has reached operating temperature, turn ignition switch off.

Diesel

Disconnect the electrical solenoid shut-off wire from the injection pump. This will keep the injection pump from pumping fuel under high pressure to the nozzle during the test.

CAUTION: The above step is important because fuel under high pressure from the injection will have sufficient force to penetrate skin. Do not, at any time, while the engine is cranking, place hands or arms in front of the injection nozzles.

Remove all three injection nozzles and seal gaskets from the head (see Section 20).

Clean the injection bores. Blow loose carbon out with compressed air.

Install a D-14550 BA Compression Gauge Adapter in bore to be tested. A new seal gasket should be inserted before the adapter is installed.

Connect D-14547 BA Compression Gauge to the adapter.

Crank engine at approximately 200 rpm with the starting motor.

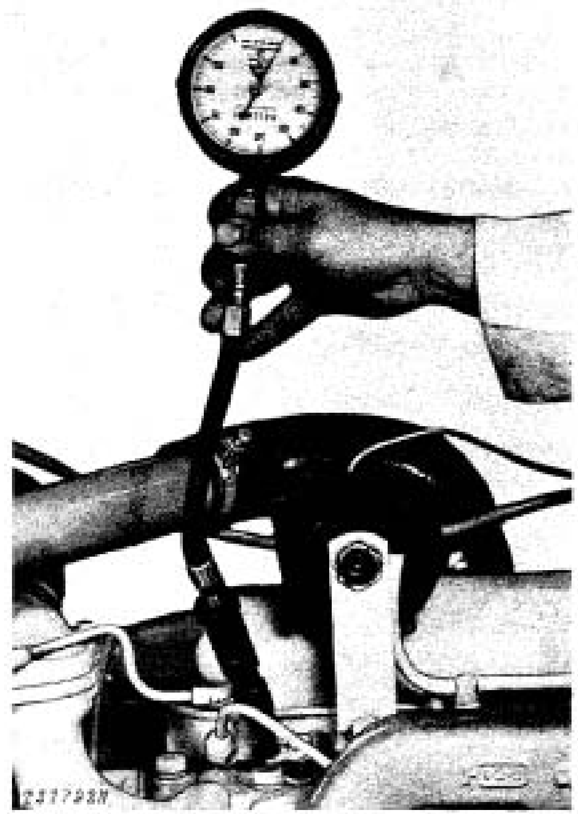


Fig. 3-Diesel Compression Test Hook-Up

Observe the pressure reading on the compression gauge. The reading should be 300 psi [21.09 kg/cm^2] for diesel.

Gasoline

Disconnect the lead wire to the carburetor electrical shut-off. This will prevent the carburetor from vaporizing and delivering any fuel.

CAUTION: Never permit fire, live sparks or smoking in the area when testing the engine.

Remove all three spark plugs from the head (see Section 40).

Clean plug bores. Blow loose carbon out with compressed air.

Install engine compression tester in bore to be tested.

Crank engine with the starting motor and the throttle wide open.

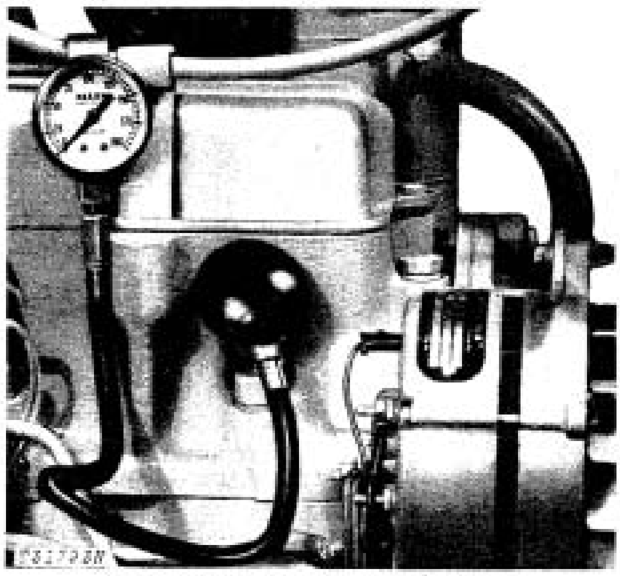


Fig. 4-Gasoline Compression Test Hook-Up

Observe the pressure reading on the compression gauge. The reading should be 120 psi [8.44 kg/cm²] for gasoline.

Test each cylinder on both diesel and gasoline several times to be sure readings are accurate.

Remove gauge and install injection nozzles (see Group 25, Section 20) or spark plugs (see Section 40).

Engine Lubrication System

Checking Engine Oil Pressure

Engine oil pressure should be checked before and after a major overhaul or anytime it is necessary to remove the oil pump.

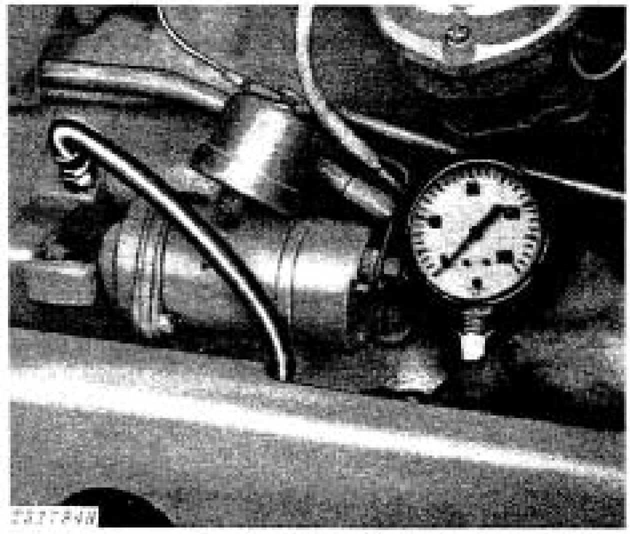


Fig. 5-Checking Engine Oil Pressure

To check oil pressure, remove oil pressure indicator switch from engine. Connect an oil pressure gauge as shown in Fig. 5.

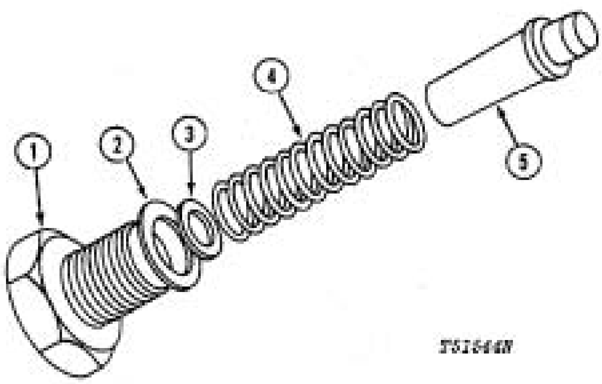
With engine at normal operating temperature and running at 2500 rpm, oil pressure reading should be 50 ± 15 psi [3.52 ± 1.05 kg/cm²].

Adjusting Engine Oil Pressure

Under normal conditions, there should be no need to adjust engine oil pressure.

If an adjustment is necessary, use the following procedure:

To increase pressure, with a large aluminum washer under the head of the regulating valve plug, insert small shims in the counterbore of the plug (total not to exceed four) until oil pressure of 50 ± 15 psi [3.52 ± 1.05 kg/cm²] at 180° to 220°F [82.2° to 104.4°C] is reached.



1—Valve Plug
2—Aluminum Washer
3—Adjusting Shim (If used)
4—Regulating Spring
5—Regulating Valve

Fig. 6-Oil Pressure Regulating Valve Assembly

To decrease pressure, remove any adjusting shims from counterbore of valve plug. To further decrease pressure, add a second large aluminum washer under head of plug.

Engine Cooling System

Since efficient operation of pressure cooling depends on a system that is free from leaks, the entire cooling system should be tested prior to servicing.

Checking Radiator for Leaks

Install a pressure tester on the radiator according to the manufacturer's instructions.

Fig. 7-Testing Radiator

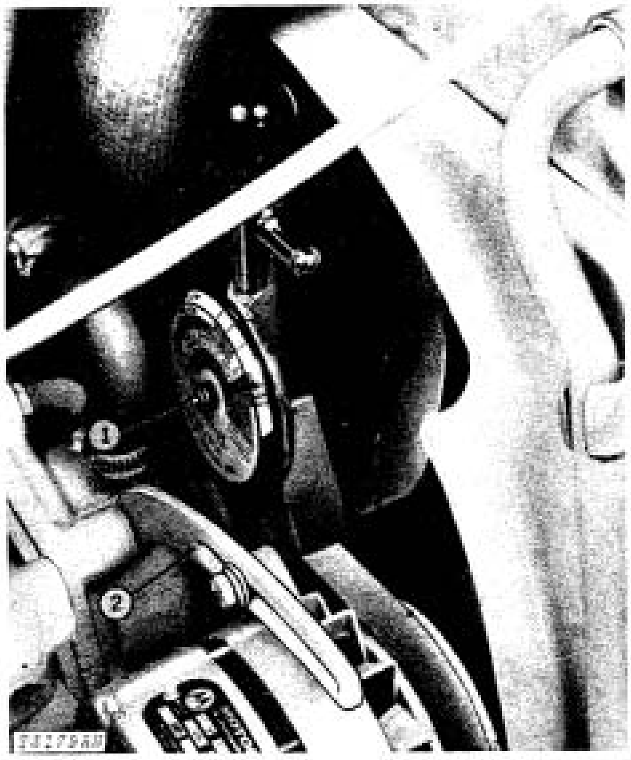
With the tester installed, carefully inspect the radiator, water pump, hoses, drain cocks, and cylinder block for leakage.

Mark all leaks plainly to help locate them when repairing.

If you cannot find any leads but leaking persists, remove the radiator and test as described in Section 20, Group 20.

FOS For additional information or testing and maintaining the cooling system refer to "Cooling System" in FOS Manual - Engines.

Fan Belt Tension Adjustment



1—Belt Tension Gauge 2—Alternator Bracket

Fig. 8-Checking Fan Belt Tension

Adjust fan belt tension by loosening the alternator bracket and adjusting cap screws and apply outward pressure to the front alternator frame to determine if the fan belts are adjusted properly, apply approximately 20 pounds (9.072 kg) of force on the belt with the thumb about midway between the pulleys. The belt deflection should be 0.75 inch (19.05 mm).

More consistent belt tension will result and the belts will last longer if the tension is set with a belt tension gauge. When a belt tension gauge is used, the initial reading should be 100 to 110 pounds (45.4 to 49.9 kg) strand tensions. After three minutes of operation recheck the belt tension. The gauge should read a minimum of 80 pounds (36.29 kg) strand tension.

Fuel System

CAUTION: Live sparks, smoking or fire of any nature should not be permitted when testing the fuel system.

Fuel Supply Pump Vacuum Test

Tee a D-05022ST Water Vacuum gauge at the inlet to the fuel supply pump.

Start the engine. Let it run at low idle and observe the gauge, the reading on the gauge should be 2.0 to 2.5 inches (50.8 to 63.5 mm) of water.

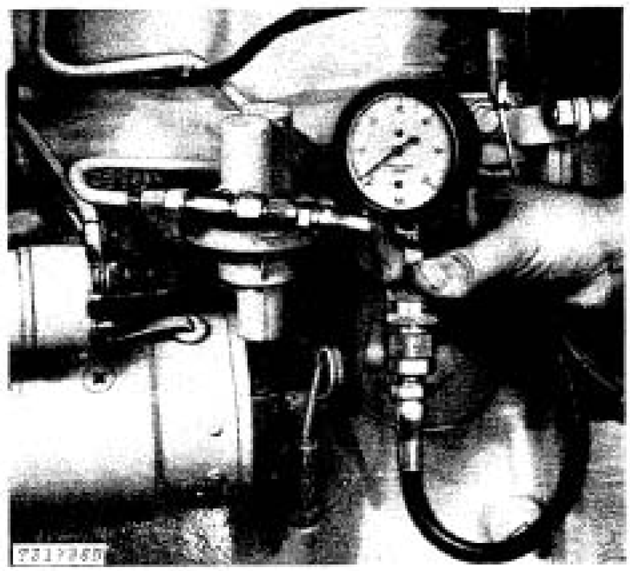
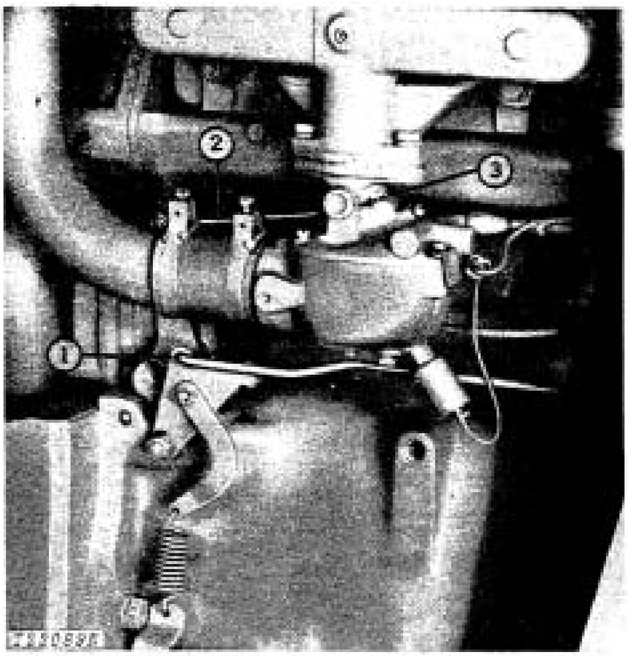


Fig. 9-Fuel Supply Pump Vacuum Test

The pump can also be tested by teeing a low pressure gauge between the pump and the fuel filter (diesel) or carburetor (gasoline). The pressure should be 2 to 2.5 psi (0.14 to 0.17 kg-cm²).

Governor Linkage Adjustment (Gasoline)



1—Governor Lever and Shaft Assembly
2—Throttle Rod
3—Throttle Lever

Fig. 10-Governor Linkage

Move the governor control lever and shaft assembly forward as far as possible. Move the carburetor throttle lever to the wide open position.

Install the throttle rod on the governor lever and adjust one turn short.

Install speed control spring in hole on top flange of governor lever. Connect spring to counterbalance arm.

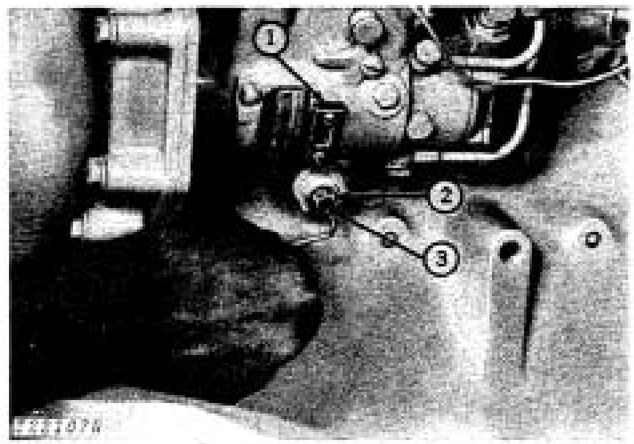
FOS For carburetor adjustment when installed on the engine refer to FOS Manual - ENGINES, "Gasoline Fuel Systems."

Adjusting Injection Pump Cam Advance (Diesel)

1 - Be sure injection pump is static timed to engine (see Group 15, Section 20).

2 - Remove timing hole cover and install timing window (JD259-13366).

Note the location of the cam timing line. Due to slight variations in windows and hole locations, cam line may not be exactly behind window line. Adjust timing window to get best possible line up.



1—Timing Window
2—Lock Nut
3—Advance Trimmer Screw

Fig. 11-Adjusting Cam Advance

3 - Bring engine to operating temperature.

4 - Check cam advance according to following specifications:

JDB331AL2406
Advance at 1300 rpm (no load) .... 4°

NOTE: Marks on timing window are two pump degrees apart.

5 - If cam advance must be adjusted loosen lock nut and turn advance trimmer screw.

Turn screw in (clockwise) to retard timing; turn screw out (counterclockwise) to advance timing.

6 - Secure trimmer screw with lock nut and install seal cap.

7 - Remove timing window and install timing hole cover.

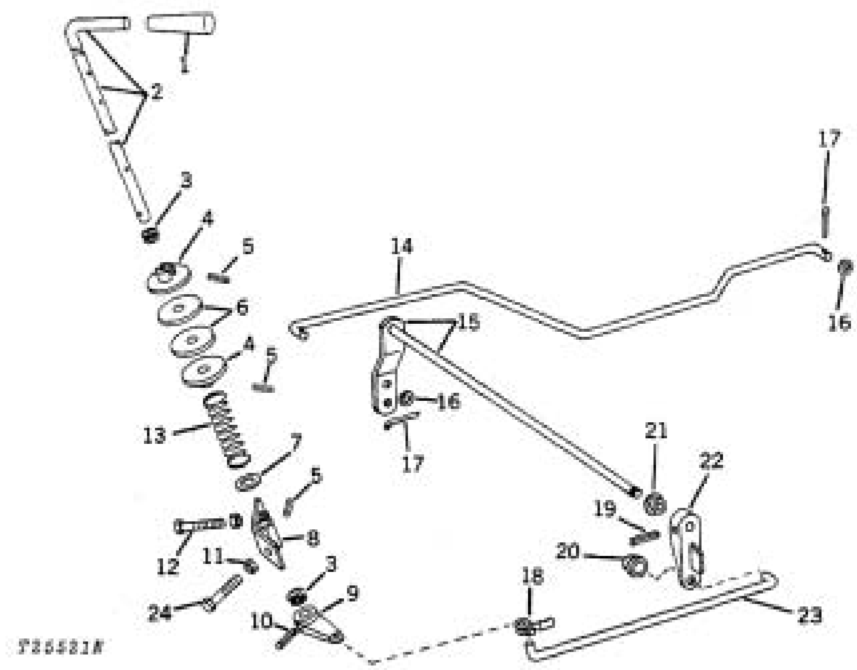
Speed Control Linkage

Repair

Refer to Figures 12 and 13 for disassembly repair and assembly of hand and foot linkages.

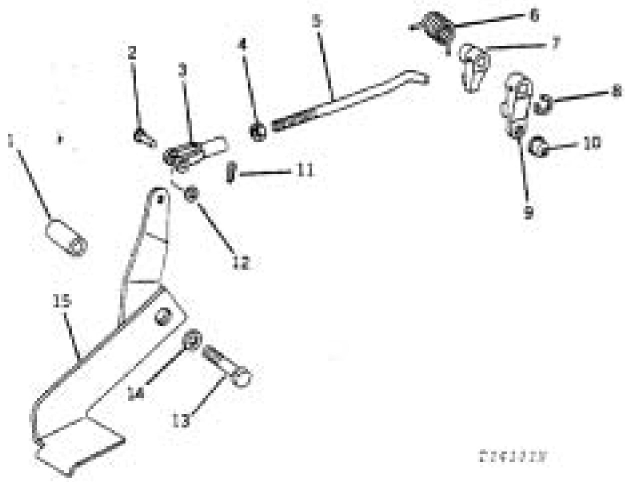
Inspect linkage parts for broken or cracked rods and arms. Check for binding, looseness or any condition that might cause poor engine performance.

When installing speed control arm (22, Fig. 12) check that spring pin (10) protrudes approximately 1/16 inch [1.5875 mm] on each side.



1—Knob
2—Lever
3—Bushing (2 used)
4—Speed Control Lever Disk (2 used)
5—Groove Pin (2 used)
6—Facing (2 used)
7—Washer
8—Stop
9—Speed Control Shaft Arm
10—Spring Pin
11—Nut
12—Slow Idle Stop Screw
13—Spring
14—Speed Control Rod
15—Speed Control Shaft
16—Washer (2 used)
17—Cotter Pin (2 used)
18—Clevis Pin
19—Spring Pin
20—Locking Cap
21—Bushing (2 used)
22—Speed Control Arm
23—Speed Control Rod
24—Fast Idle Stop Screw

Fig. 12-Hand Speed Control Linkage

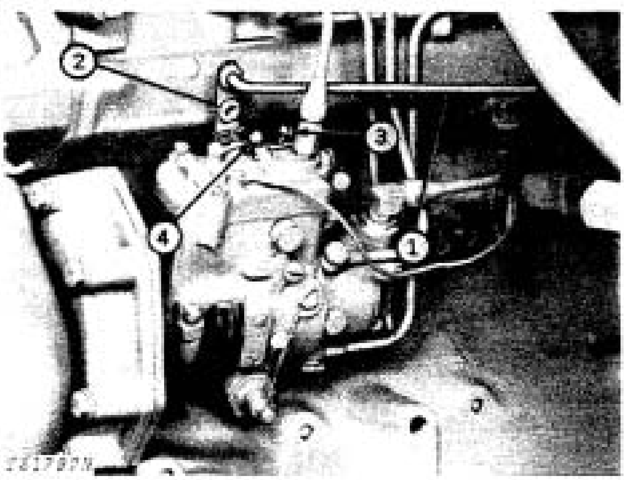


1—Spacer
2—Pin
3—Yoke
4—Nut
5—Accelerator Rod
6—Return Spring
7—Speed Control Shaft Arm
8—Retaining Ring
9—Speed Control Outer Arm
10—Locking Cap
11—Cotter Pin
12—Washer (2 used)
13—Cap Screw
14—Washer
15—Accelerator Pedal

Fig. 13-Foot Throttle Linkage

Speed Control Adjustments (Injection Pump)

Diesel



1—Speed Control Rod
2—Throttle Lever
3—Fast-Idle Stop Screw
4—Slow-Idle Stop Screw

Fig. 14-Injection Pump Adjustments

With speed control rod (Fig. 13) disconnected from the injection pump throttle lever, run engine and rotate pump throttle lever to rear until it touches stop. Engine speed should be at fast idle (2650 rpm). If not, adjust pump fast-idle stop screw to correct.

Lightly rotate pump throttle lever forward to slow-idle position. Engine speed should be a slow-idle (800 rpm). If not, adjust at slow-idle stop screw.

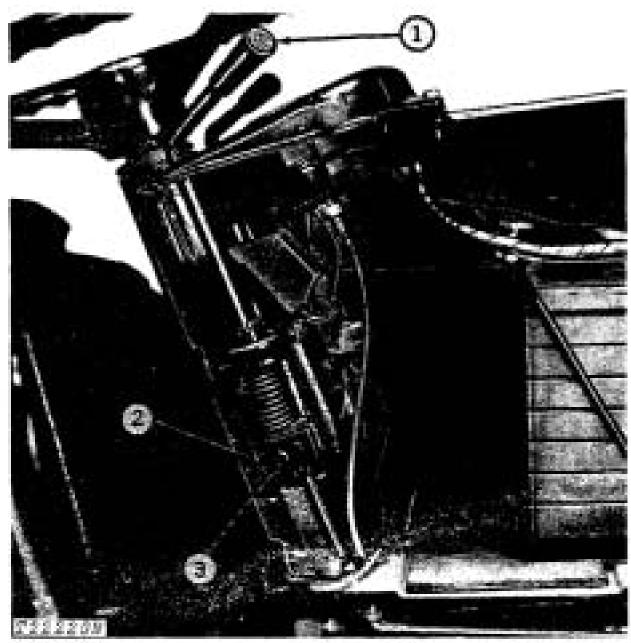
Speed Control Adjustments (Linkage)

Make all speed control adjustments in the exact order given. Be sure engine is warmed up before making speed adjustments. Attach a master tachometer to check engine speeds.

Gasoline

1. Adjust carburetor-to-governor throttle rod one turn short when governor lever and carburetor throttle are both in the wide open position.

2. With speed control rod disconnected from governor lever, move governor lever to the extreme forward position.



1—Speed Control Lever
2—Slow-Idle Stop Screw
3—Fast-Idle Stop Screw

Fig. 15-Gasoline Speed Control Adjustments

3. Rotate speed control lever (1, Fig. 15) counter-clockwise until speed control rod end is 1/8-inch (3.175 mm) distance past the governor lever attaching hole. Position slow-idle stop screw (2, Fig. 15) against dash and lock with nut. Connect speed control rod to governor lever. Lever will now be slightly preloaded. Engine speed should be at slow idle (600 rpm). If not, adjust carburetor idle adjusting screw for correct idle.

4. Turn speed control lever clockwise to obtain fast idle (2680 rpm). Position fast-idle stop screw head (3, Fig. 15) against dash and lock with jam nut (Fig. 15).

5. Adjust pedal linkage to obtain 2800 rpm when pedal is against foot rest.

6. Place tractor under load and readjust carburetor load needle as necessary. If engine backfires as clutch is engaged, open the needle slightly. If black smoke comes out of the muffler, close the load needle slightly. If carburetor cannot be properly adjusted, clean and overhaul it as covered in Group 25, Section 20.

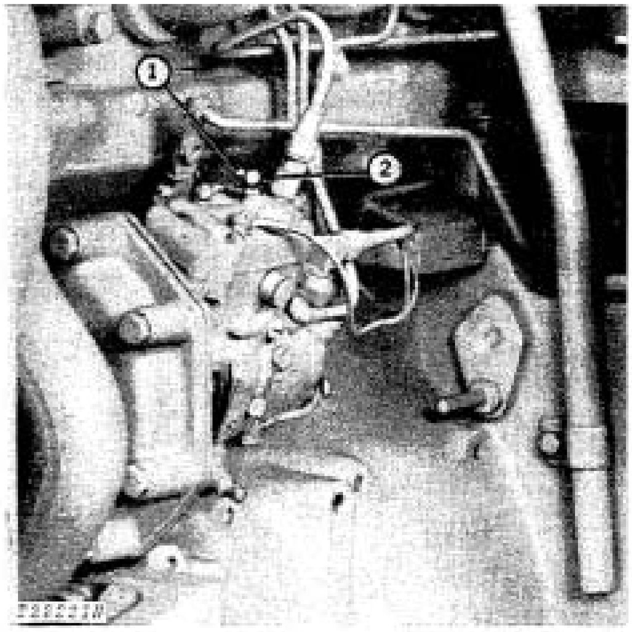
Diesel

1. Disconnect speed control rod from injection pump lever and adjust pump fast and slow idle to specifications as follows:

2. Disconnect speed control rod (14, Fig. 12) from injection pump arm.

3. Run engine and rotate pump throttle arm until fast-idle stop screw (1, Fig. 16) contacts its stop. Engine speed should be at 2650 ± 25 rpm fast idle. If not, adjust fast-idle stop screw to correct. Lock screw with sealing wire.

4. Lightly rotate pump throttle arm to slow-idle position. Engine speed should be at 825 ± 25 rpm slow idle. If not, adjust slow-idle stop screw (2, Fig. 16) to correct.



1—Fast-Idle Stop Screw **2—Slow-Idle Stop Screw**

Fig. 16-Diesel Speed Control Adjustments

5. Connect speed control rod to injection pump arm. Rotate speed control lever (1, Fig. 15) counter-clockwise until pump arm is preloaded to 1/4 inch [6.35 mm] against its stop. Position slow-idle stop screw head (2) against dash and lock with jam nut.

6. Move speed control lever clockwise until fast-idle is reached. Position fast-idle stop screw head against dash and secure with lock nut.

7. Adjust foot throttle rod (5, Fig. 13) so that pump lever is preloaded 1/4 inch when engine is running at 2800 rpm.

Air Intake System

Intake Manifold Vacuum Test (Gasoline)

Remove pipe plug from intake manifold above carburetor.

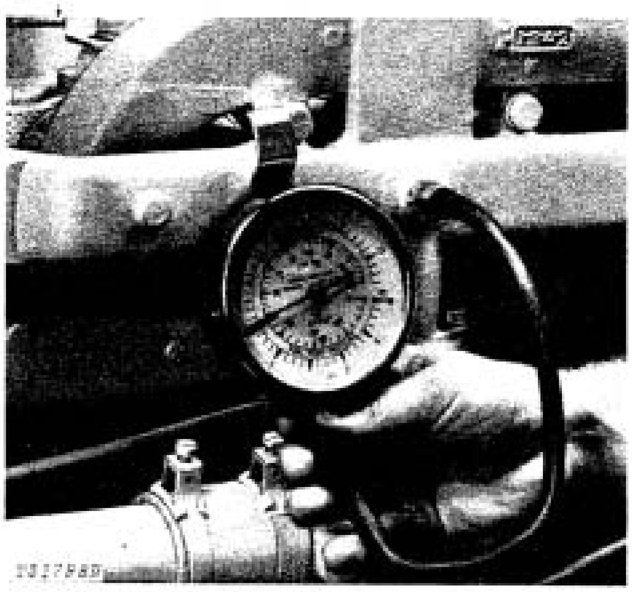


Fig. 17-Checking Intake Manifold Vacuum

Install a mercury vacuum gauge to intake manifold. Run engine at 2650 ± 25 rpm high idle. The gauge should read 15 to 20 inches (381 to 508 mm) of mercury.

Shut off engine and remove gauge. Apply permatex to threads of pipe and reinstall in intake manifold.

Testing Air Restriction Indicator

Remove left side grille from unit. Remove air restriction indicator.

Fig. 18-Checking Air Restriction Indicator

Install a "T" fitting into restriction indicator. Install restriction indicator on one end of "T" and D-05022ST Water Vacuum Gauge on other end.

Start the engine and slowly cover air intake pipe. Observe reading on water vacuum gauge. Restriction indicator should show red when water vacuum gauge reads 14 to 25 inches (355.6 to 635 mm) of water on diesel and gas engines.

Remove water vacuum gauge, restriction indicator and "T" fitting. Install indicator and side grille.

Group 15
ELECTRICAL SYSTEM

GENERAL INFORMATION

This group contains trouble shooting tips, wiring diagrams and test specifications necessary to locate trouble in the system. By following the tests as given, the faulty component may be located and removed for further testing, repair, or replacement.

Tests and service instructions for system components when removed from the unit, are provided in Section 30.

A 12-volt negative system is used to supply the electrically operated components of this unit. Current is supplied by one 12-volt battery or two 12-volt batteries connected in parallel for cranking the engine and operating the accessories when the engine is not running.

The electrical system is a combination of five electric circuits: the charging circuit, the starting circuit, the ignition circuit, the light circuit, and the accessory circuit.

Batteries

The batteries are the heart of the electrical system. During operation, the storage batteries function as an electrochemical device for converting chemical energy into electrical energy required for cranking the engine or operating the accessories when the engine is shutdown.

The batteries do not actually store electricity as is commonly believed, but they do convert electricity into chemical energy which is stored until the batteries are converted to an external circuit, at which time the chemical energy is transformed back into electrical energy and current flows through the circuit.

For good operation, the batteries must do three jobs:

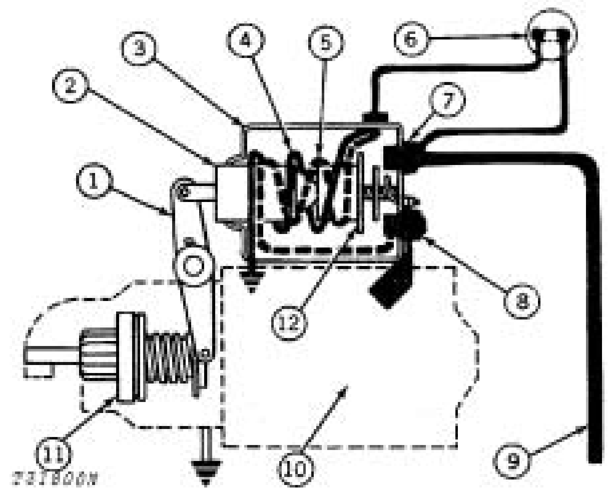
1. Supply current for starting the engine.

2. Supply current when the demand exceeds the output of the charging system.

3. Stabilize the voltage in the system during operation.

Starting Circuit

The starting circuit consists of the batteries, starting motor with solenoid switch, start-safety switch, key switch and connecting wires.



1—Shift Lever
2—Plunger
3—Solenoid
4—Hold-In Winding
5—Pull-In Winding
6—Key Switch
7—Battery Terminal
8—Motor Terminal
9—Battery Positive Cable
10—Starting Motor
11—Overrunning Clutch
12—Contact Disk

Fig. 1-Solenoid Circuit

When the key switch is turned to the "start" position the battery current flows into the hold-in winding and also to the armature coils through the pull-in and field windings, and brushes.

Then the solenoid plunger is pulled in by means of magnetic pull produced by pull-in and hold-in windings, and overrunning clutch is pushed out on the armature shaft by the drive lever to engage the pinion with the flywheel ring gear. At this time, the pinion is partially engaged with the ring gear before the contact plate closes between the contacts.

When the contacts are fully closed, a huge battery current flows directly into field windings and to the armature coils through the contact plate, and energizes the armature to spin creating a large torque. This pushes the clutch pinion further to engage completely with the ring gear. As the armature rotates, the overrunning clutch also rotates, and the rollers between the clutch shell and pinion collar are moved into the narrower portion of the notches in the shell. This action locks the pinion to the armature shaft and permits the transfer of torque to the pinion for engine cranking.

Once the solenoid switch plunger is pulled in, less magnetism is needed to hold it in. Thus the pull-in winding is shorted with the contact plate, and only the hold-in winding operates to hold the plunger in place as long as the key switch remains closed.

Once the engine has started, the flywheel gear will tend to drive the armature through the pinion faster than the armature is running. The pinion, rotating faster than the clutch shell, turns the rollers back into the larger portion of the notches against spring tension. This permits the rollers to unlock and turn freely so that the pinion will overrun the clutch shell but not drive the armature.

With the key switch released after engine starting the current flows from the contact plate to both the pull-in and hold-in windings in the same direction. As these windings are wound to have their magnetic fields act in opposite directions so that they cancel each other. The plunger returns to the rest position by means of the return spring, demeshing the pinion from the flywheel.

FOS — For additional information on starting circuits, refer to "Starting Circuits" in FOS Manual - ELECTRICAL SYSTEMS.

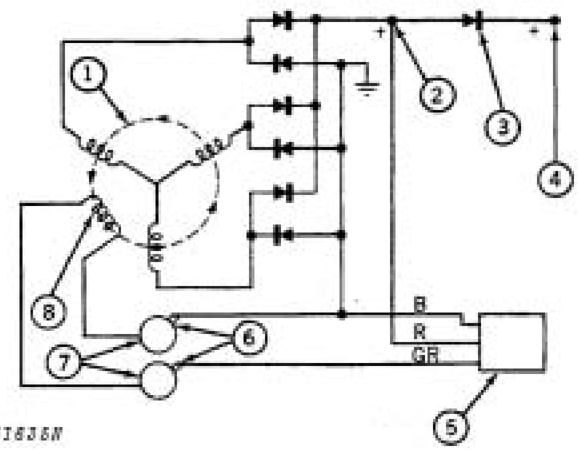
Charging Circuit

FOS — For information on fundamentals of an alternator charging circuit, refer to "Charging Circuits" in FOS Manual - ELECTRICAL SYSTEMS.

The alternator is an electric generator that produces alternating current. An alternator has a high current output at low speeds.

In an alternator, the magnetic field of the rotor is moved across stationary conductors in the stator. This permits permanent connection between the stator windings and the output terminal. Slip rings are used to transmit the field current to the rotor field winding.

The alternator produces power in the form of three phase alternating current and voltage. The alternating current is rectified to direct current by a three phase full wave rectifier circuit using six silicon rectifier diodes. Since the diode will pass current in only one direction (from alternator to battery or load), the alternator does not require the use of a cutout relay.



Z31636N

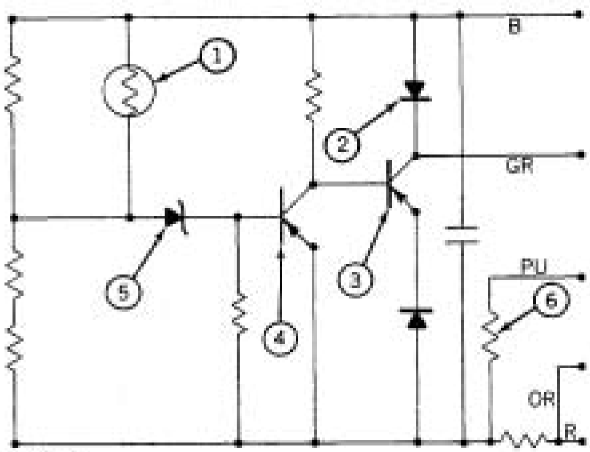
1—Stator
2—Regulator Terminal
3—Isolation Diode
4—Output Terminal
5—Regulator
6—Brushes
7—Rotor Slip Rings
8—Rotor Winding (Field)

Fig. 2-Alternator Circuit

The entire DC output of the system passes through the isolation diode. This provides the system with several distinct advantages. It prevents the battery from discharging through the regulator and alternator field without the use of relays or switches. Electrically, the indicator lamp is connected across the isolation diode. When the system is operating properly, the alternator output voltage is very nearly the same as the battery voltage. This means that the voltage potential across the isolation diode is low and the indicator lamp shows that the alternator is charging.

The alternator output current is controlled by the current flow through the field coil (rotor). The amount of current required is determined and controlled by the regulator. Since there is very little residual magnetism in the alternator, it is necessary to supply a small amount of excitation current to the field (rotor) to start the process of current generation. The excitation resistor supplies this starting current when the key switch is turned on. This resistor is enclosed in the sealed regulator case. Once the alternator is excited, a voltage is developed at the regulator terminal and the voltage regulator takes over control of the system voltage.

The transistor regulator is an electronic switching device composed principally of transistors, resistors, and diodes to form a completely static unit containing no moving parts.



T31658N

1—Thermistor (RT)
2—Field Discharge Diode
3—Transistor (T-2)
4—Transistor (T-1)
5—Zener Diode
6—Excitation Resistor

Fig. 3-Voltage Regulator Complete Circuit

The transistors are used to switch the alternator field current on and off and are controlled by the resistors and the Zener diode.

A Zener diode is a special diode that will break down and permit a reverse flow of current when the voltage reaches a certain value without damaging the semiconductor material. This diode is the trigger which senses the maximum desired voltage and turns the transistor on or off to limit charging system voltage.

The field discharge diode provides an alternate current path to protect the transistors from induced high voltage from the alternator field windings. The sudden stopping of field current by the transistor and subsequent collapsing of the magnetic field causes an induced voltage in the rotor windings.

The thermistor (RT) is a temperature compensating resistor. Its resistance varies with temperature and controls the operating point of the Zener diode so that a higher system voltage is produced in cold weather, when needed, and a lower system voltage in warm weather.

The diagram in Fig. 3 is a complete voltage regulator circuit. Its operation is as follows.

When the voltage appearing at the output terminal of the alternator rises to a predetermined value (14.4 volts), the voltage which appears across the Zener diode is the critical Zener voltage and the Zener diode conducts. This conduction of the Zener diode permits current to flow in the base of transistor T-1. This causes transistor T-1 to turn on and reverse bias transistor T-2, thus turning off the current applied to the alternator field.

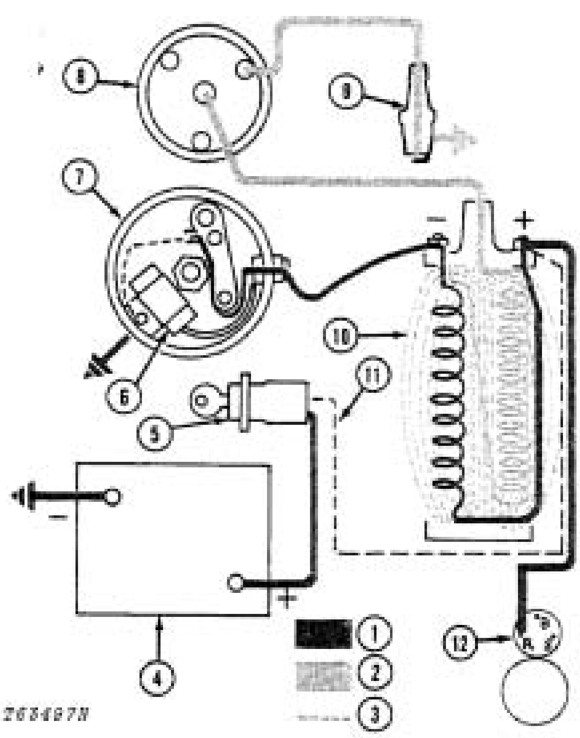
When the system voltage drops below the predetermined value, the Zener diode stops conducting, T-1 turns off and T-2 turns on. When transistor T-2 is switched on, field current again is supplied to the alternator.

The operation of transistor T-2 is in effect like, a switch, turning the alternator field current on and off as the electrical supply varies due to the varying electrical load. This action occurs many times a second, so fast it cannot be detected in the alternator output.

FOS

For additional information on transistor regulator, see Charging Circuits in FOS Manual - ELECTRICAL SYSTEMS.

Ignition Circuit



Z63497N

1—Primary Circuit
2—Secondary Circuit
3—Magnetic Field
4—Battery
5—Key Switch
6—Condenser
7—Distributor
8—Distributor Cap
9—Spark Plug
10—Coil
11—Resistance Wire
12—Solenoid

Fig. 4-Ignition Circuit

With the key switch on, current flows through the primary circuit shown in red, that is from the battery through the primary winding of the ignition coil and closed distribution contacts to ground, and then back to the battery.

Current flow through coil primary windings creates a magnetic field. In a small fraction of a second (build-up time), current flow and magnetic field reach their maximum value.

When the contact points open, the current decreases very rapidly in the ignition coil primary windings, and a high voltage is induced in the coil secondary winding.

This high secondary voltage forces a current flow to distributor rotor which directs secondary current to the proper spark plug. The secondary current jumps spark plug air gap to the grounded electrode and ignites the fuel-air mixture to provide the power stroke.

The secondary electrons flow from the coil secondary windings, across the distributor rotor gap and spark plug gap, and then back to the secondary winding through ground, the battery and key switch. The distributor contact points then reclose, and the cycle repeats. The next firing spark plug then will be the one connected to the distributor cap insert that is aligned with the rotor when the contact separate.

With the engine running, current flows through the coil primary resistor, the other lead connected between the coil and key switch. This resistance wire is designed to protect the distributor contacts from excessive arcing and burning.

When the contacts separate, a high voltage because of self-induction is induced in the coil primary winding. This voltage may be about 250 volts, which causes an arc to form across the distributor contacts.

To bring the primary current to a quick controlled stop, and in order to greatly reduce the size of the arc and thereby ensure prolonged contact point life, a capacitor is connected across the distributor contacts. The high voltage induced in the coil primary winding causes the capacitor plates to charge when the contacts first separate. The capacitor acts initially like a short circuit and current flows into the capacitor to minimize arcing at the contacts.

FOS D

For additional information on ignition circuits, refer to "Ignition Circuits" in FOS Manual - ELECTRICAL SYSTEMS.

Block Diagram

A block diagram is a simple picture of the power flow in the electrical system. It provides an easy to follow description of the system components and their relationship to other components.

Use the block diagram (Fig. 6) to follow the basic power distribution to the various circuits.

Trace the current by starting at the battery positive terminal and follow the connecting lines from box to box. Current flows from the batteries to the starting motor and then to the alternator and key switch. As you can see this provides a very basic and simple picture of the current or power distribution in the system.

By looking at the output of the key switch, you can see that the current flow is further distributed out of three terminals: "ACC", "IGN" and "ST".

The components in each of these circuits can be determined very easily by following the connecting lines from box to box.

Now let's use the block diagrams to solve a problem.

Problem: Lights do not work, but the alternator and engine oil pressure indicator lamps are lit when key switch is in "ACC" position.

Solution: By referring to the block diagram (Fig. 6) you can see that there is power to the key switch. Therefore, the problem must be in the lead wire from the key switch "ACC" terminal through the regulator connector to the light switch "BAT" terminal or the light switch itself.

Schematic Diagram

The schematic diagram (Fig. 7) is a detailed "How It Works" picture of the electrical system. It provides the theory of operation in a simple, easy-to-understand manner. The schematic is especially helpful in trouble-shooting to isolate a problem to a given component.

To use a schematic diagram, it is essential that you know and understand the basic symbols used in an electrical schematic.

FOS

For explanation of basic symbols of an electrical schematic, refer to FOS Manual - ELECTRICAL SYSTEMS, page IV.

To use the electrical schematic, you must think of the electrical current as flowing from the positive (+) terminal of the batteries through the various circuits and components to ground, and from ground back to the negative (−) terminal of the battery.

If circuit is complete to ground, positive current flow is from the batteries to the starting motor solenoid "BAT" terminal, to the alternator and on to the key switch.

Now let's use the schematic to solve a problem.

Problem: Horn will not work, but cigar lighter works.

Solution: By referring to the schematic diagram you can see that the cigar lighter and horn get their power from the same terminal on the circuit breaker. So the problem is either in the switch, the horn or the wiring from the circuit breaker to horn switch or from horn switch to horn.

Precautions

Certain precautions should be followed when testing or servicing the electrical system.

CAUTION: To avoid injury from a spark or short circuit, DISCONNECT THE BATTERY GROUND STRAP when working on any part of the electrical system. This will also prevent accidental starting.

When removing the batteries, disconnect the battery ground strap first. When installing the battery, connect the ground strap last.

NEVER REVERSE THE POLARITY OF THE BATTERY CONNECTIONS. Reversing the polarity may damage some components and wiring in the system.

DO NOT ATTEMPT TO POLARIZE THE ALTERNATOR after connecting the battery. No polarization is needed. Any attempt to do so may damage the alternator, regulator, or circuits.

If booster batteries are used to help start the engine, be sure to connect them properly. Connect the negative (−) terminal of the booster battery to the negative (−) terminal of the machine battery, and connect the positive (+) terminals to each other

When using booster batteries, prevent fire hazards as follows:

1. When possible, use equipment with a switch in the line connecting the booster battery to the machine battery.

2. Always "rock" the connector clips to make sure they are secure.

3. If only jumper cables are available, always connect the machine battery first; then when connecting the booster battery, be very careful in handling the cable clips. When disconnecting always break the connection at the booster battery first.

When connecting a fast charger to a battery in a machine, be very careful. First remove the battery ground strap to prevent fire hazards and damage to the alternator.

Do not lay metal tools or other objects across the battery as they may create a short circuit.

CAUTION: GAS FROM BATTERY ELECTROLYTE IS FLAMMABLE. Keep all sparks and fires away from the battery. When charging the battery gas is created more rapidly. Be sure the room where the battery is charged is well ventilated.

CAUTION: BATTERY ACID IS HARMFUL ON CONTACT with the skin or most materials. See Group 5, Section 30 for first aid tips when acid comes in contact with skin.

Never operate the alternator in an open circuit.

Never short or ground the alternator terminals.

Do not disconnect the voltage regulator while the alternator is running.

IMPORTANT: Disconnect battery ground strap prior to welding on unit.

VISUAL INSPECTION

Carefully inspect the electrical system for tips on the malfunction. Check to see if the unit can be operated without further damaging the system.

Always check these items before turning on switches or running the unit.

1. Look for bare wires that could cause grounds or shorts and dangerous sparks. Shorted wires can damage the charging system.

2. Look for loose or broken wires. They can damage the regulator.

3. Inspect all connections, especially battery connecting points. Acid film and dirt on the battery may cause current flow between the battery terminals, resulting in current leakage. Check the battery ground strap for proper operation.

4. Check the battery electrolyte level. Continued loss of electrolyte indicates overcharging. Check for acid film and dirt on top of battery.

5. Check the alternator drive belt tension.

6. Inspect for overheated parts after the unit has been stopped for a while. They will often smell like burnt insulation. Put your hand on the alternator or regulator. Heat in these parts when the unit has not been operated for some time is a sure tip-off to charging circuit problems.

If your visual inspection does not indicate the possible malfunction, but your inspection does indicate that the machine can be run, first turn the key switch to the "accessory" position. Try out the accessory circuits - alternator-indicator light, gauges, and lights. How do each of these components work? Look for sparks or smoke which might indicate shorts.

Turn the key switch to the "start" position. Now start the machine. Check all gauges for good operation, and check to see if the system is charging or discharging.

In general, look for anything unusual.

Many electrical failures cannot be detected even if the machine is started. Therefore, a systematic and complete inspection on the electrical system is necessary. See "System Testing" in this section.

DIAGNOSING MALFUNCTIONS

Batteries

Undercharged Battery

Excessive loads from added accessories.
Excessive engine idling.
Accessories left on.
Low charging system voltage.
Low charging system output.
Continuous drain on battery.

Low Battery Output

High resistance in circuit.
Low electrolyte level.
Low specific gravity.
Defective battery cell.
Cracked or broken battery case.
Low battery capacity.

Battery Uses Too Much Water

Cracked battery case.
Battery being overcharged.
Defective battery.

Starting Circuit

Indicator Lamp Fails To Light

Indicator lamp burned out.
Defective ground.
Defective key switch.
Defective wiring from battery to key switch.

Solenoid Switch Chatters

Low battery.
Poor connection.
Open in solenoid hold-in circuit.

Starting Motor Spins But Will Not Crank Engine

Damaged overrunning clutch pinion.
Broken drive lever.
Broken drive lever pivot bolt.
Broken magnetic switch plunger hook.
Defective overrunning clutch.

Engine Cranks Slowly

Burnt or poor solenoid switch contacts.
Poor contact of brush or worn out brushes.
Burnt commutator.
Commutator mica too high.
Shorted or grounded armature coil.
Poor tension on brush spring.
Armature rubbing pole core.
Low battery charge.
High resistance in battery cables.

Starting Motor Keeps Running

Defective starting motor solenoid.
Short in wiring.

Noise Produced At Engine Cranking

Armature interfering with stationary components.
Starting motor drive gear worn.

Starting Motor Will Not Spin, Engine Will Not Crank

Burnt or poor magnetic switch contacts.
Open, shorted, or grounded magnetic switch pull-in windings.
Open, shorted, or grounded magnetic switch hold-in winding.
Poor contact of brush or worn out brushes.
Burnt commutator.
Commutator mica too high.
Open or grounded field winding.
Open, shorted, or grounded armature coil.
Poor tension on brush spring.
Grounded positive side brush holder.

If starting motor does not operate connect a voltmeter to the solenoid "S" terminal and a good ground. Turn key switch to start position.

Voltmeter Indicates Battery Voltage

Defective starting motor.
Defective solenoid switch.

Voltmeter Does Not Indicate Battery Voltage.

Defective key switch.
Defective neutral start switch.
Defective wiring between key switch and neutral start switch.
Defective wiring between battery and solenoid "S" terminal.

Charging Circuit

Low Charging System Voltage

High resistance in circuit connections.
Defective wiring.
Low amperage output of alternator.
Defective regulator.
Defective batteries.

Low Charging System Output

Slipping drive belts.
Excessively worn or sticking brushes.
Dirty or out-of-round slip rings.
Grounded, shorted, or open field circuit.
Defective diodes and alternator.
Defective regulator.

High Charging System Voltage

High resistance at regulator connections.
Defective regulator.

Noisy Alternator

Defective drive belt.
Worn or defective bearings.
Loose mounting or drive belt.
Pulley not aligned.
Diodes shorted or open.

Ignition Circuit

Lack of Power

Incorrect timing.
Pitted distributor points.

Hard Starting

Weak spark.

Engine Overheats

Advance mechanism sticking.

Engine Knocks

Incorrect timing.

Engine Backfires

Advance mechanism sticking.

Engine Misfires

Dirty spark plugs.
Faulty cables.
Incorrect distributor point gap.

Engine Uses Too Much Fuel

Fouled spark plugs.
Incorrect timing.

Engine Runs Irregularly

Faulty ignition.

Slow Acceleration

Advance mechanism sticking.
Defective coil or condenser.
Faulty distributor points.

Engine Will Not Start

Faulty coil.
Faulty condenser.
Faulty distributor points.
Coil high tension wire out of socket.
Cracked distributor rotor.
Faulty spark plugs.
Incorrect timing.
Spark plug cables installed incorrectly.

Engine Starts But Will Not Continue to Run

Faulty coil.
Faulty condenser.
Faulty distributor points.

Poor Ignition of Fuel

Incorrect spark plug gap.
Dirty spark plugs.
Faulty cables.
Incorrect timing.
Faulty distributor points.
Faulty condenser.
Defective coil.
Cracked distributor cap or rotor.
Defective wiring.

Gauges

If A Gauge Does Not Register

Lack of current to the gauge.
Poor ground connection.
Connecting wire grounded to unit.
A defective sending unit or gauge.

If A Gauge Consistently Registers Too High

Poor connection between gauge and connecting wire.
Broken connecting wire.
Poor ground at sending unit.
Failure of gauge or sender, usually the sender.

Fuel Gauge Shows Empty

Poor ground of receiver.
Lack of current to receiver.
Grounded wire between receiver and sender.
Hole in sender float.

Fuel Gauge Shows Full

Poor ground of sender.
High resistance or open circuit in wire between receiver and sender.
Defective sender or receiver.

Horn

Horn Operates After Tapping

Points open because of wear or maladjustment.
Foreign particle between points (horn will operate normally the next time).

Horn Has No Current Draw

Broken lead.
Open contact (turn screw counterclockwise).
Open circuited winding.

Excessive Horn Current Draw

Closed points (turn screw clockwise).

Indicator Lights

Alternator Indicator Light Out With Key Switch On

Loose or broken connector wire.
Open alternator field circuit.
Indicator lamp burned out.

Oil Pressure Indicator Light Will Not Light

Burnt-out bulb.
Open circuit or excessive resistance in wiring.
Defective lamp body.
Faulty oil pressure switch.

Oil Pressure Light Remains On With Key Switch Off

Defective lamp body.
Grounded wire to oil pressure switch.
Faulty oil pressure switch.

Cigar Lighter

Cigar Lighter Does Not Function

Circuit breaker in lighter tripped.
Faulty lighter element or lighter shell.
Defective wiring.

Carburetor and Injection Pump Solenoid

High Current Draw

Shorted windings.

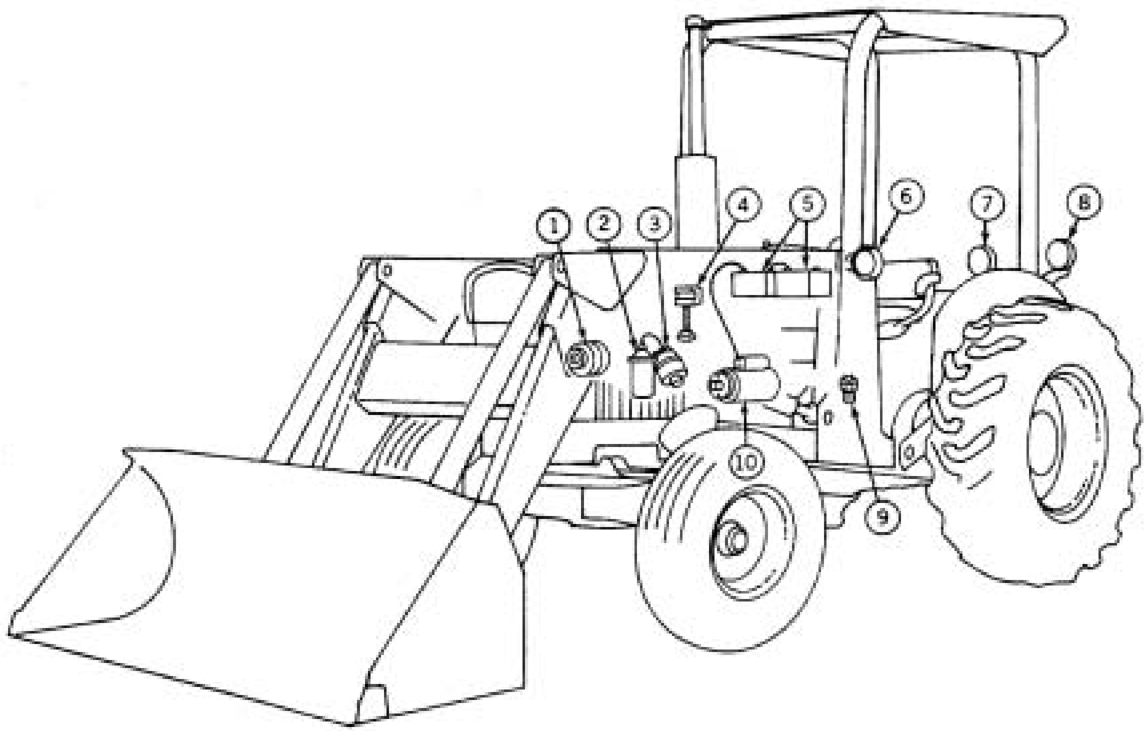
Low or No Current Draw

High resistance at internal connection.
High resistance in connector or wire.
Open circuited windings.

Lights

Dim Lights

High resistance in circuit or poor ground on lights.
Low battery charge.
Defective key switch or light switch.



T31910N

1—Alternator
2—Coil
3—Distributor
4—Regulator
5—Batteries
6—Front Headlights
7—Combination Flood and Taillight
8—Warning Lamp
9—Start-Safety Switch
10—Starting Motor

Fig. 5-Component Location

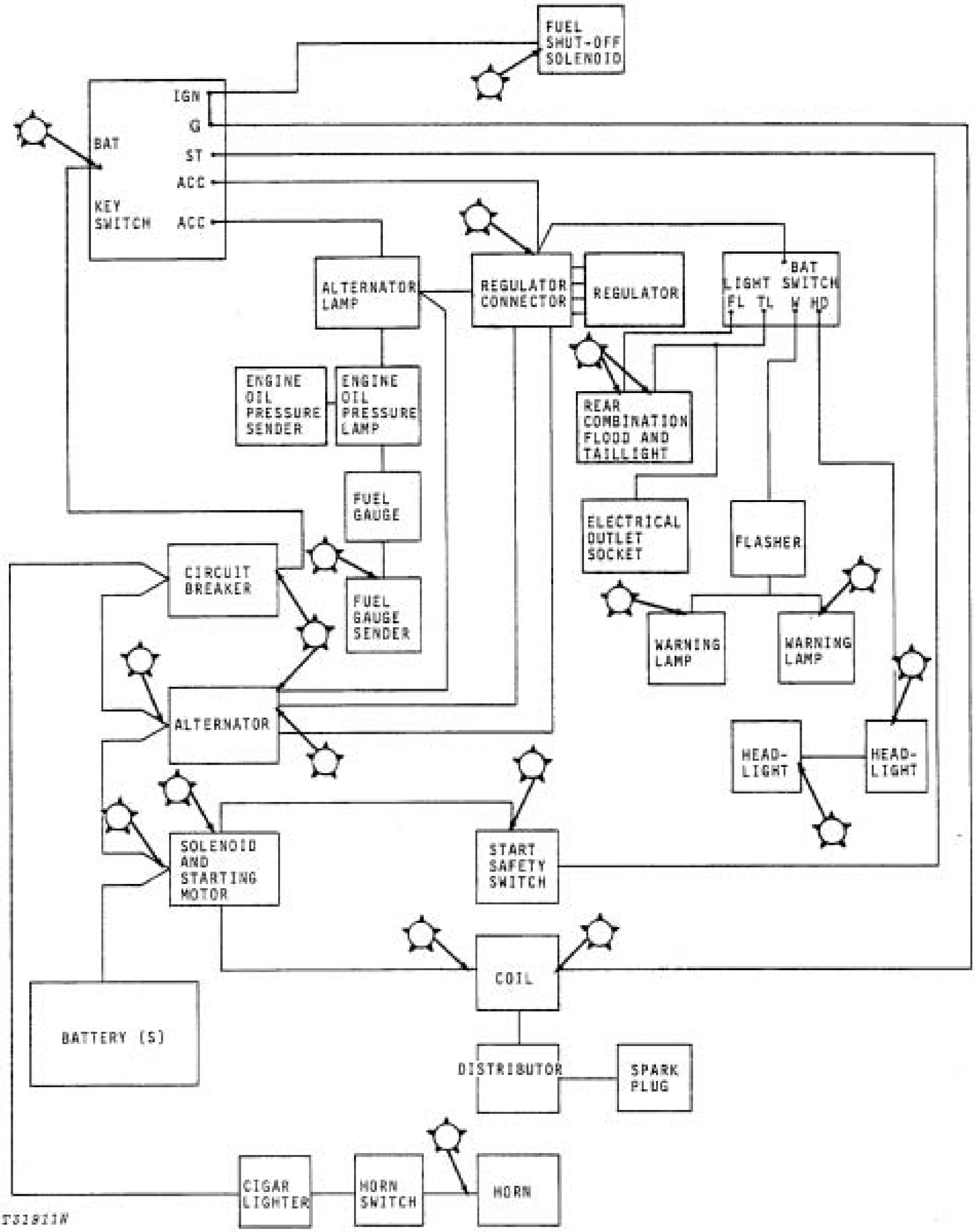
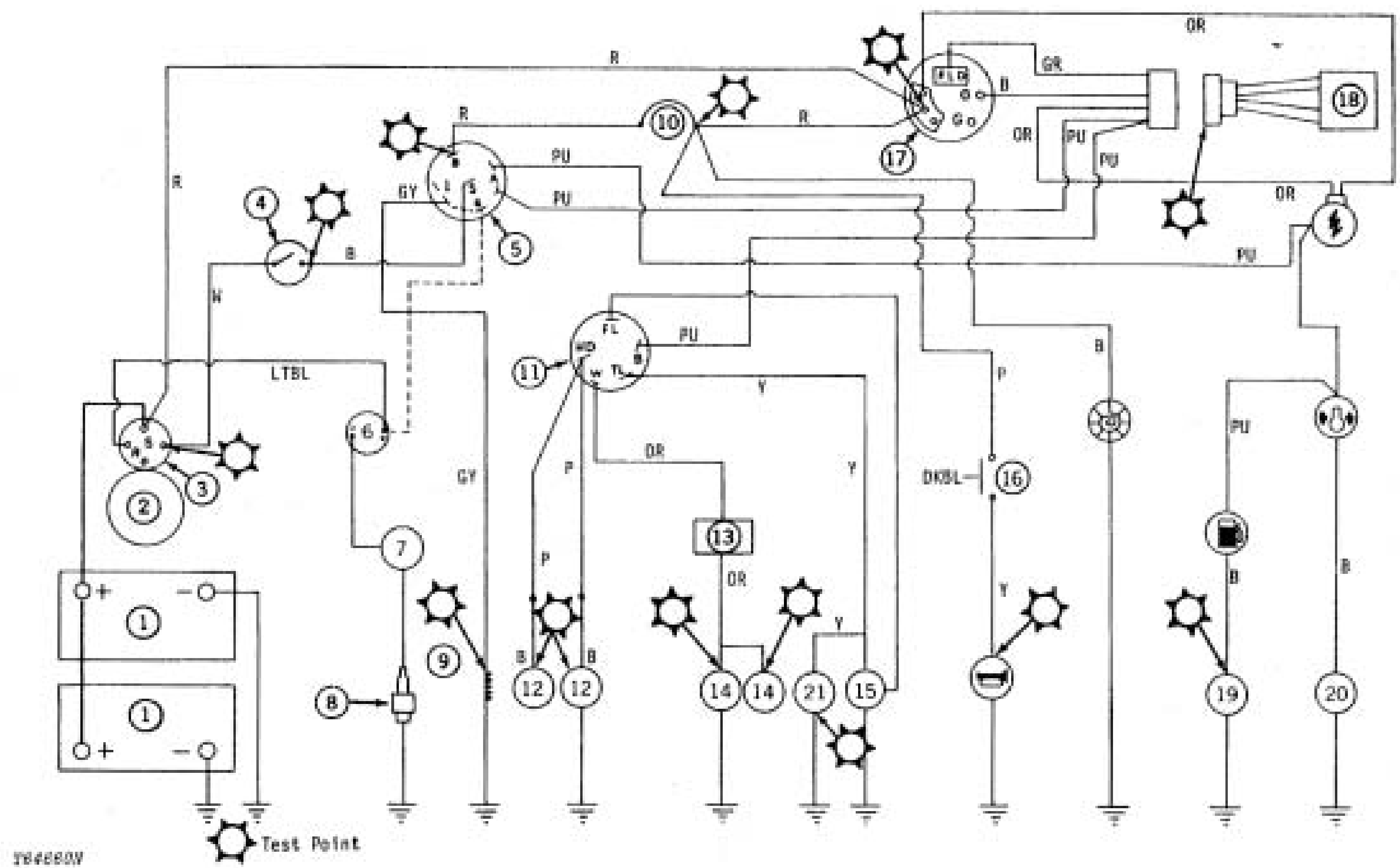


Fig. 6-Electrical System Block Diagram



1—Battery
2—Starting Motor
3—Solenoid
4—Neutral Start Switch
5—Key Switch
6—Coil*
7—Distributor*
8—Spark Plug*
9—Fuel Shut-Off Solenoid
10—Circuit Breaker
11—Light Switch
12—Front Headlights (2 used)
13—Flasher
14—Warning Lamps (2)
15—Combination Flood and Taillight
16—Horn Switch
17—Alternator
18—Regulator
19—Sending Unit (Fuel Gauge)
20—Sending Unit (Oil Pressure)
21—Outlet Socket
* —Gas Only

B—Black
BL—Blue
LTBL—Light Blue
OR—Orange
GY—Gray
DKBL—Dark Blue
P—Pink
PU—Purple
R—Red
W—White
Y—Yellow
GR—Green

Fig. 7-Electrical Schematic.

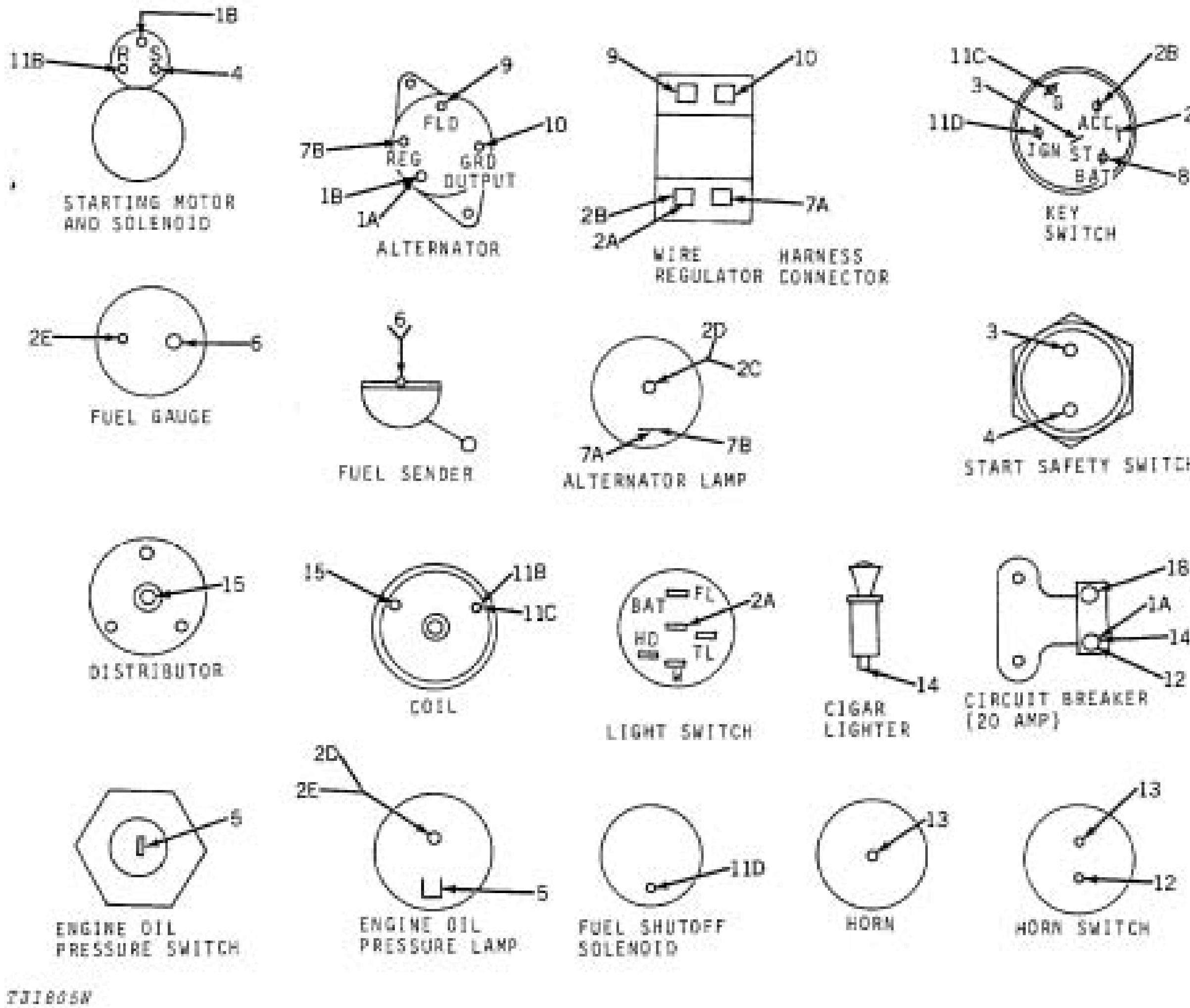


Fig. 8-Component Wire Routing (Part I)

The following is an explanation of Fig. 8 - Component Wire Routing.

No.	Color	Routing
1A*	Red	Alternator output terminal to circuit breaker
1B	Red	Alternator output terminal to solenoid "BAT" terminal
2A	Purple	Regulator connector to light switch "BAT" terminal
2B	Purple	Regulator connector to key switch "ACC" terminal
2C	Purple	Key switch "ACC" terminal to alternator indicator light connector
2D	Purple	Alternator indicator light connector to engine oil pressure indicator light connector
2E	Purple	Engine oil pressure indicator light connector to small terminal on fuel gauge.
3	Black	Key switch "ST" terminal to start safety switch
4	White	Start safety switch to solenoid "S" terminal
5	Black	Engine oil pressure indicator light to engine oil pressure switch
6	Black	Fuel gauge to fuel gauge sender connector
7A	Orange	Regulator connector to alternator indicator light
7B	Orange	Alternator indicator light to alternator regulator terminal
8	Red	Circuit breaker to key switch "BAT" terminal
9	Green	Alternator field terminal to regulator connector
10	Black	Alternator ground terminal to regulator connector
11B	Light Blue	Solenoid "R" terminal to coil
11C	. . . . . .	2.2 ohm., 20 watt resistance wire from coil to key switch "G" terminal
11D	Gray	Key switch "IGN" terminal to fuel shut-off solenoid
12	Pink	Circuit breaker to horn switch
13	Yellow	Horn switch to horn
14	Black	Circuit breaker to cigar lighter
15	Black	Coil to distributor

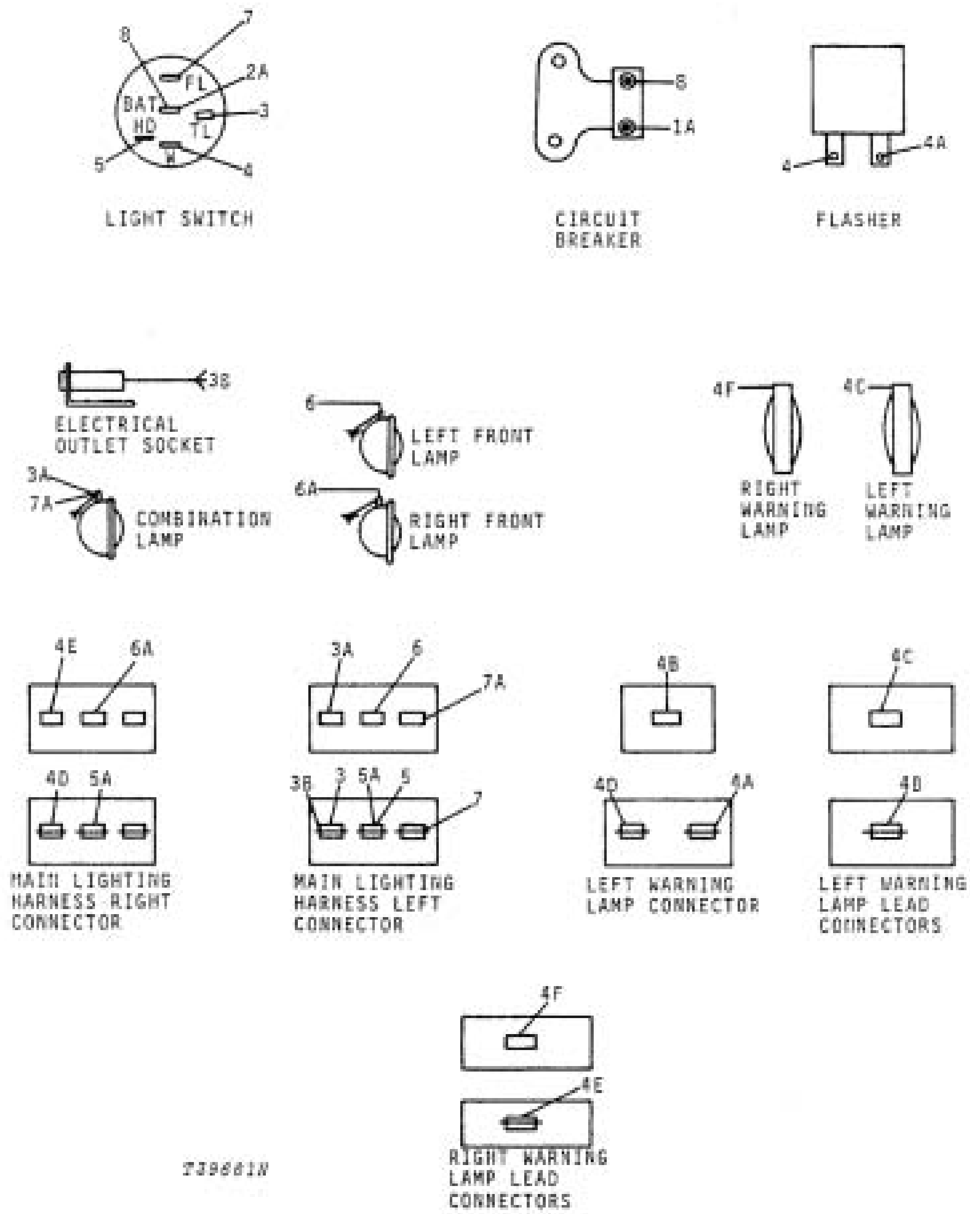


Fig. 9-Component Wire Routing (Part II)

The following is an explanation of Fig. 9 - Component Wire Routing.

No.	Color	Routing
1A	Red	Power to circuit breaker from alternator output terminal.
2A*	Purple	Power to light switch from regulator connector
3	Yellow	Light switch "TL" terminal to main lighting harness left connector
3A	Yellow	Main lighting harness left connector to combination flood and taillight connector
3B	Yellow	Main lighting harness left connector to electrical outlet connector
4	Orange	Light switch "W" terminal to flasher
4A	Orange	Flasher to left warning lamp connector
4B	Orange	Left warning lamp connector to left warning lamp lead connector
4C	Orange	Left warning lamp lead connector to left warning lamp connector
4D	Orange	Left warning lamp connector to main lighting harness right connector
4E	Orange	Main lighting harness right connector to right warning lamp lead connector
4F	Orange	Right warning lamp lead connector to right warning lamp connector
5	Pink	Light switch "HD" terminal to main lighting harness left connector
5A	Pink	Main lighting harness left connector to main lighting harness right connector
6	Black	Main lighting harness left connector to left front headlight
6A	Black	Main lighting harness right connector to right front headlight
7	Dark Blue	Light switch "FL" terminal to main lighting harness left connector
7A	Dark Blue	Main lighting harness left connector to combination flood and taillight connector
8*	Red	Circuit breaker to light switch "BAT" terminal

**When 2A purple lead is connected to light switch "BAT" terminal, key switch must be turned on for lights to operate.*

When 8 red lead is connected to light switch "BAT" terminal lights will operate independent of key switch.

TESTING AND ADJUSTMENT

The circuits tested in this group are the charging circuit, starting circuit, ignition circuit, accessory circuit and light circuit.

Failure of the engine to crank may be due to one of a number of causes. Any one of several units in the starting circuit may be at fault, or the cause of failure may be due to a weak battery. Another reason for failure could be broken, disconnected or loose leads or corroded connections.

Therefore, both a visual and an electrical check should be made to isolate trouble before removing any unit, otherwise a component may be removed needlessly, only to find it is not the cause of cranking failure.

Always use accurate electrical test equipment when making electrical tests. Faulty equipment will prevent the servicemen from doing thorough work and may damage the electrical system.

Before you start the circuit tests, quickly review the precautions on page 70, 15-5 and make the following checks:

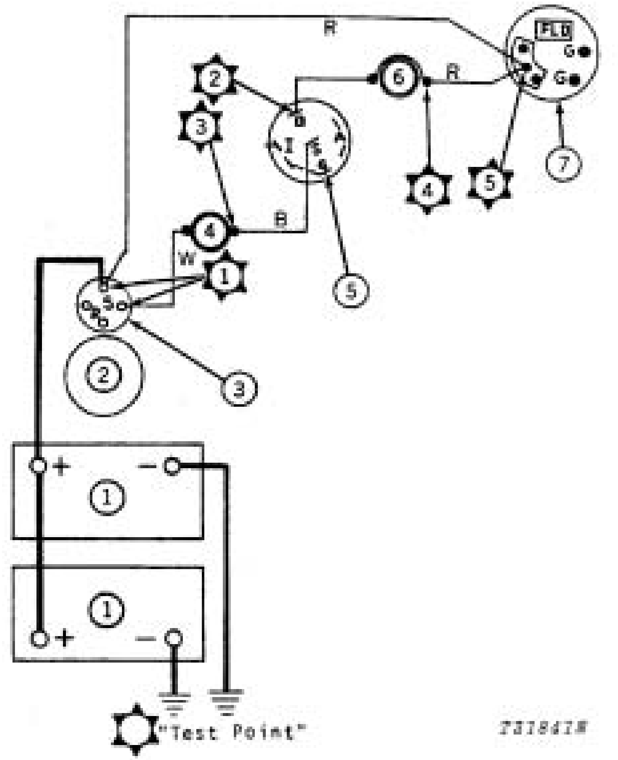
1. Check battery electrolyte level.
2. Look for corroded terminals.
3. Check for acid film and dirt on top of battery.
4. Check battery polarity.
5. Test the charge of the battery (nine volts minimum for testing system).

System Short Test

Following is a simple method to locate an electrical system short quickly:

1. Be sure battery is fully charged.
2. Disconnect the negative cable from the battery.
3. Connect a 12-volt test lamp between the negative battery post and the disconnected cable.
4. If there is a short, the test lamp will glow with all accessories turned off.
5. By disconnecting and reconnecting each electrical circuit, one at a time, the shorted circuit can be located.
6. When a disconnected circuit causes the test lamp to go out, you've found the culprit. Now all that remains is to trace that circuit, then locate and correct the cause of the short.

Testing the Starting Circuit



1—Batteries
2—Starting Motor
3—Solenoid
4—Start-Safety Switch
5—Key Switch
6—Circuit Breaker
7—Alternator

Fig. 10-Starting Circuit

Battery condition should be determined first. It is vital to the testing of the starting circuit problem to have the battery fully charged and free of shorted or dead cells. Use the following test to determine voltage available to battery.

1. Attach positive (+) voltmeter lead to positive (+) battery post. Attach negative (−) voltmeter lead to negative (−) battery post (Fig. 11).

2. Crank engine.

Fig. 11-Checking Battery Voltage

3. Voltmeter should read at least 9 volts. If above the minimum, continue testing. If below minimum, replace or recharge battery.

When the key switch is turned to the start position, you can expect one of five things to occur if the starting circuit is defective:

1. Nothing happens - there is no "click" indicating that the solenoid contacts did not close.

2. An audible "click" in the solenoid is heard, but the starting motor does not operate.

3. The starting motor is running, but the engine does not turn over.

4. The starting motor turns over the engine slowly or erratically.

5. The engine starts but the starting motor drive does not disengage from the flywheel.

You can check out these five problems as follows.

1 - Nothing Happens

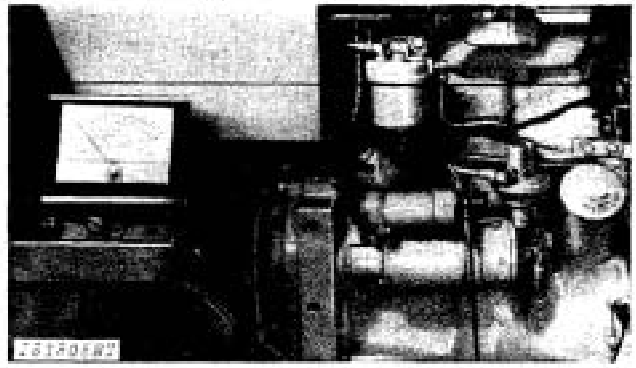


Fig. 12-Voltmeter Connected to Solenoid "S" Terminal

Connect voltmeter to solenoid "S" terminal and to ground (Fig. 12). With shift lever in neutral position, turn key switch to start position. Voltmeter should read 9 to 12 volts.

If there is a voltage reading of 9 to 12 volts, the problem is in the solenoid. See Section 30, Group 15 for "Solenoid Tests".

If there is no voltage reading connect voltmeter to solenoid "BAT" terminal. Voltmeter should read 9 to 12 volts.

If there is a reading of 9 to 12 volts proceed to Test No. 2.

If there is no voltage reading check for a defective battery cable or poor and corroded connections.

Test No. 2

Remove left hand cowl panel.

Insert a straightened paper clip into the key switch connector at the red lead. Connect voltmeter to paper clip (Fig. 13). Voltmeter should read 9 to 12 volts.

Fig. 13-Voltmeter Connected to Key Switch

If no voltage reading, proceed to Test No. 4.

If there is a voltage reading of 9 to 12 volts, proceed to Test No. 3.

Test No. 3

Remove transmission case shield.

Insert a straightened paper clip into the black lead and connect voltmeter to paper clip (Fig. 14). Turn key switch to start position. Voltmeter should read 9 to 12 volts.

If there is no voltage reading and there was a reading of 9 to 12 volts in Test No. 2, the key switch is defective or black lead from key switch to start safety switch is open. Replace as necessary.

If there is a reading of 9 to 12 volts, connect the black and white leads together. Turn key switch to start position. Now if the engine cranks the start safety switch is your problem. Adjust or replace it as necessary. See Section 70, Group 20 for adjustment procedure.

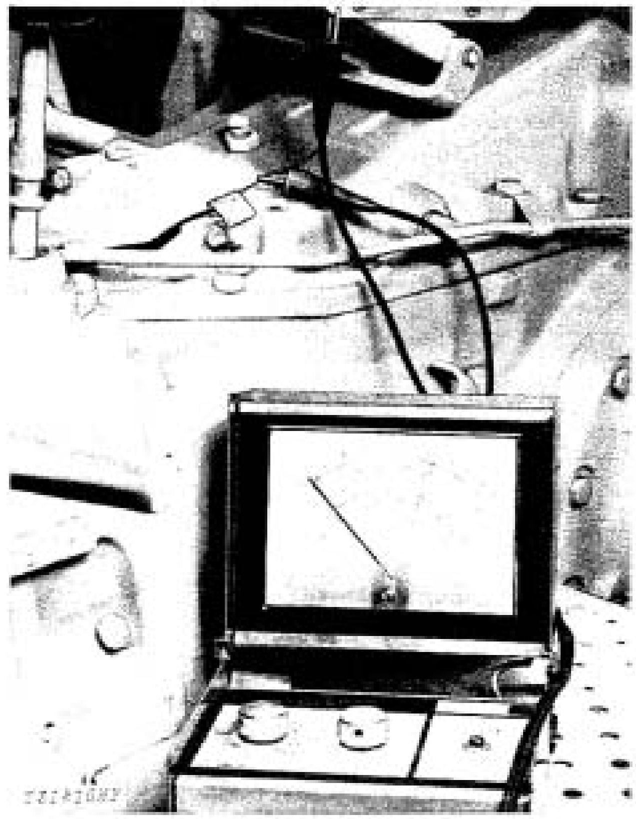


Fig. 14-Voltmeter Connected to Start - Safety Switch Black Lead

Test No. 4

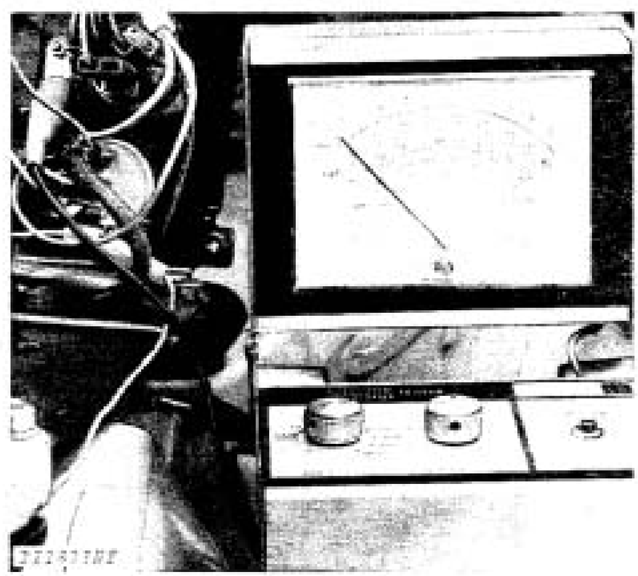


Fig. 15-Voltmeter Connected to Circuit Breaker

Connect voltmeter to circuit breaker terminal with the black, purple and red leads (Fig. 19). Voltmeter should read 9 to 12 volts.

If there is a reading of 9 to 12 volts and there was no voltage reading in Test No. 2 the circuit breaker is defective or the wire from circuit breaker to key switch is open. Replace as necessary.

If there is no voltage reading, proceed to test No. 5.

Test No. 5

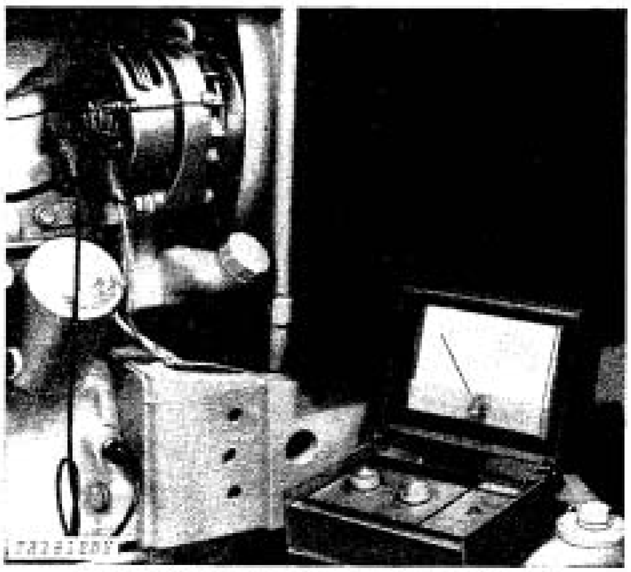


Fig. 16-Voltmeter Connection to Alternator Output Terminal

Connect voltmeter to alternator output terminal (Fig. 16). Voltmeter should read 9 to 12 volts.

If there is no reading and there was reading of 9 to 12 volts at solenoid "BAT" terminal in Test No. 1, check red lead from solenoid to alternator for an open.

If there is a reading of 9 to 12 volts and there was no voltage reading in Test No. 4, check red lead from alternator output terminal to circuit breaker for an open.

2. Solenoid Contacts "Clicked" but the Starting Motor Did Not Operate

This indicates that the circuit problems lie within the solenoid. If the solenoid switch contacts close, and the switch begins to "chatter" an open circuit exists in the hold-in winding of the solenoid. In any case, the starting motor should be removed and solenoid tested as covered in Section 30, Group 15.

3. Starting Motor Ran but Did Not Turn the Engine Over.

We know that the starting motor is getting enough current to operate. The problem, then, is either in the shifting of the drive assembly into mesh, a broken armature shaft, or a dirty or faulty drive assembly. These causes require disassembly of the starting motor for proper service or repair. See Section 30, Group 15.

4. Starting Motor Turned the Engine Over Slowly or Erratically

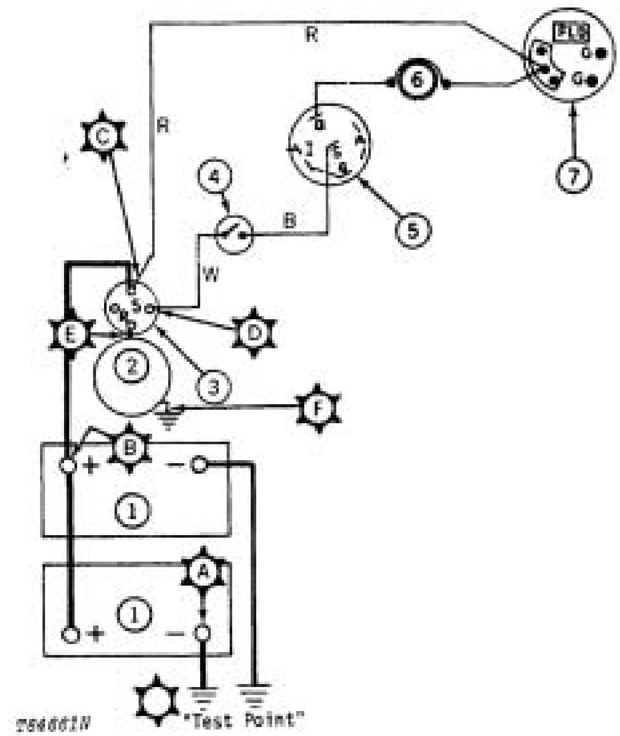
With slow sluggish starting motor operation, connect a voltmeter across the battery terminals and operate starting motor. With a slow running starting motor the voltage should be less than 9 volts. If move than 9 volts, check for high resistance between the batteries and the starting motor. See "High Resistance Test".

If voltage reading is less than 9 volts, cause is either the batteries or the starting motor. Check battery condition first. See Section 30 for testing batteries and starting motor.

High Resistance Test

Detach high tension coil wire from distributor and ground it. On diesel tractors, disconnect wire from injection pump solenoid shut-off terminal.

Connect voltmeter to ground and to solenoid battery terminal. Operate starter and compare voltage with a similar reading at battery. Always use a pin connector at battery post. If difference is more than 0.8 volt, make the tests indicated in Fig. 17. Check for defective wires or faulty connections.



1—Batteries
2—Starting Motor
3—Solenoid
4—Neutral Start Switch
5—Key Switch
6—Circuit Breaker
7—Alternator

Fig. 17-High Resistance Test Points

RESISTANCE TEST

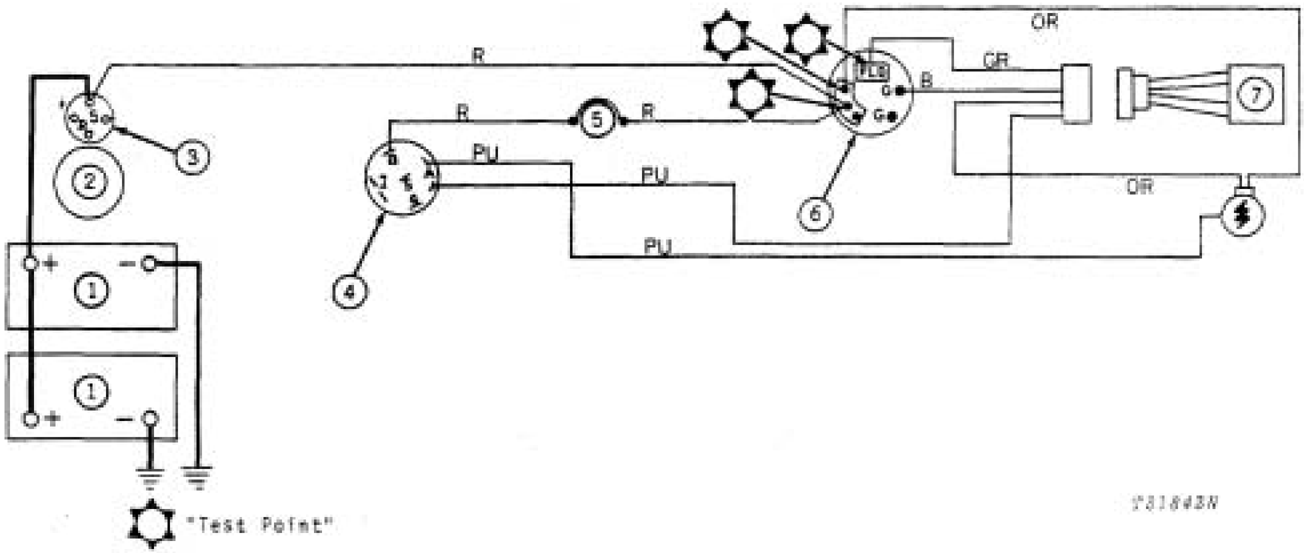
Test Points	Maximum Voltmeter Reading
A-F	0.2
B-C	0.2
C-D	1.0
C-E	0.2

5. Engine Starts But the Starting Motor Drive Does Not Disengage From the Flywheel

This indicates a defect in the drive mechanism, or solenoid pull in windings, or solenoid contacts, or solenoid control circuit which will not allow the drive to disengage.

The starting motor or solenoid needs repairing. See Section 30, Group 15.

Testing the Charging Circuit



1—Batteries
2—Starting Motor
3—Solenoid
4—Key Switch
5—Circuit Breaker
6—Alternator
7—Regulator

Fig. 18-Charging Circuit

Before you start the circuit tests, quickly review the precautions listed on page 70-15-5.

Make the following tests to isolate a faulty component in the charging circuit.

Test No. 1 - Isolation Diode Check (Key Switch Off)

Connect voltmeter negative lead to alternator ground terminal. Connect positive lead to alternator regulator terminal (Fig. 19). Voltmeter should indicate zero voltage.

If voltage reading is same as voltage at output terminal, the isolation diode is shorted. Replace it.

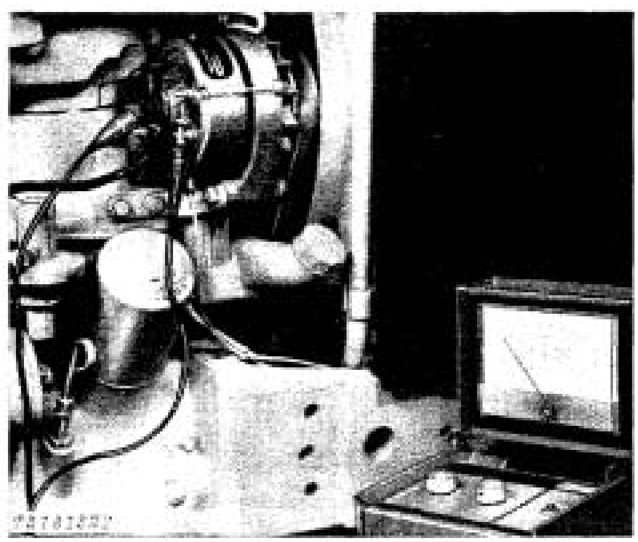


Fig. 19-Voltmeter Connected to Regulator Terminal

Test No. 2 - Field Circuit Check (Key Switch On Engine Not Running)

Connect voltmeter negative lead to alternator ground terminal and positive lead to regulator terminal (Fig. 19). Voltmeter should read 1.5 to 2.5 volts.

If voltage is greater than 3 volts, field circuit is defective; check brushes.

If no voltage is read, check purple wire at regulator connector to see that it is connected to 12 volt source.

If voltage was not correct in above test, make test No. 4. If field draw test indicates field circuit is good and voltmeter still reads high at regulator terminal with key switch on, voltage regulator is open and should be replaced.

Test No. 3 - Isolation Diode Check (Key Switch on Engine Running)

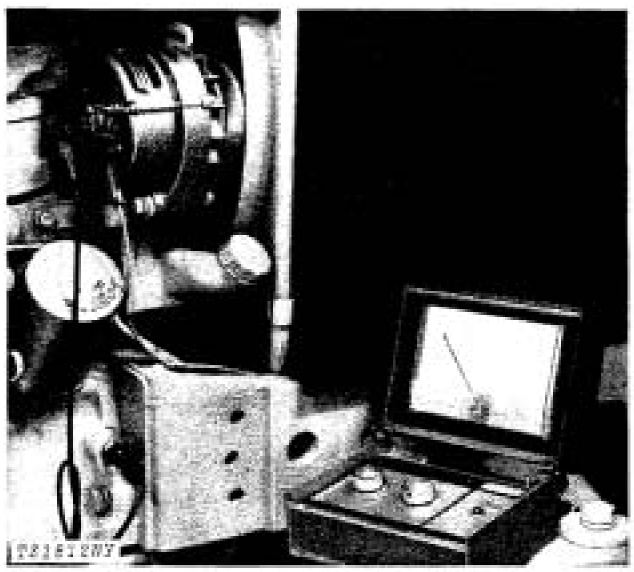


Fig. 20-Voltmeter Connected to Output Terminal

Start engine and run at approximately 1500 rpm. Connect voltmeter negative lead to alternator ground terminal and connect positive lead to alternator regulator terminal (Fig. 19). Voltmeter should read 15.4 volts. Now move voltmeter positive lead to alternator output terminal (Fig. 20). Voltage reading should be 14.4 volts.

If voltage at regulator terminal is 15.4 volts, while at the output terminal it is 12 volts or battery voltage, the isolation diode is open. Replace it.

Test No. 4 - Field Draw Test (Key Switch Off)

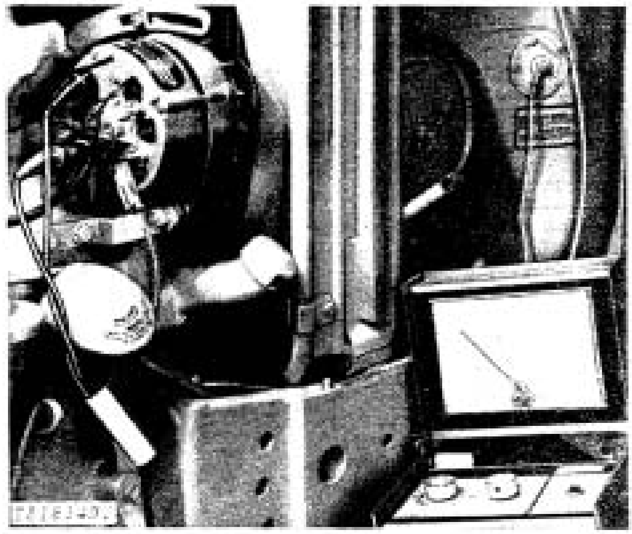


Fig. 21-Ammeter Connected to Field and Output Terminals

NOTE: If test ammeter is not equipped with a 1/4-ohm resistor, a 1/4-ohm resistor should be connected in series with the ammeter to protect the meter.

Disconnect green field wire from field terminal. Connect ammeter from output terminal to field terminal (Fig. 21). Current reading should be 2 to 2.5 amps. If less than this, check brushes and slip rings.

Test No. 5 - Checking Alternator and Regulator With Regulator Disconnected (Key Switch on Engine Running)

Disconnect the regulator from the connector. Disconnect the green wire from the field terminal. Connect a jumper wire from the output terminal to the field terminal. Connect voltmeter negative lead to ground terminal and connect voltmeter positive lead to regulator terminal (Fig. 22).

Start engine and run at slow idle. This test isolates the defect to either the alternator or regulator.

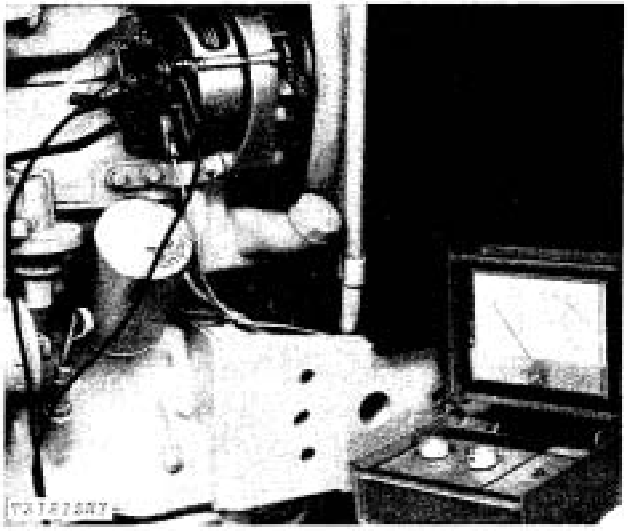
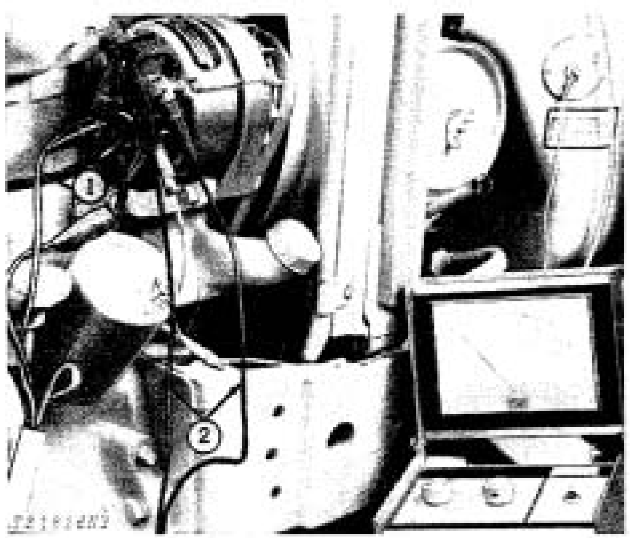


Fig. 22-Jumper Wire Connected to Field and Output Terminals and Voltmeter Connected to Regulator Terminal

If voltage at regulator terminal rises to 15-16 volts now, when it did not with regulator connected in test No. 3, then the regulator is defective and should be replaced.

If voltage does not rise at regulator terminal and the field circuit was okay in test No. 4, then the stator or rectifier diodes are defective. See Section 30, Group 10 for testing diodes and stator.

Test No. 6 - Alternator Output



1—Ammeter Leads 2—Voltmeter Leads

Fig. 23-Ammeter and Voltmeter Connected to Output Terminal

If not using JDST-23 tong type ammeter, disconnect wire from alternator output terminal and connect ammeter (Fig. 23). Connect voltmeter negative lead to ground and connect positive lead to output terminal. Connect a carbon pile resistor (turned off) to the battery.

Run engine at approximately 1400 rpm. Use a master tachometer to measure rpm. Adjust carbon pile to obtain maximum alternator output at 13 to 15 volts. Ammeter should read 25 amps or more.

Test No. 7 - Testing Regulator

The regulator must be checked with an alternator that is in good condition. If the alternator is questionable, check it as previously instructed.

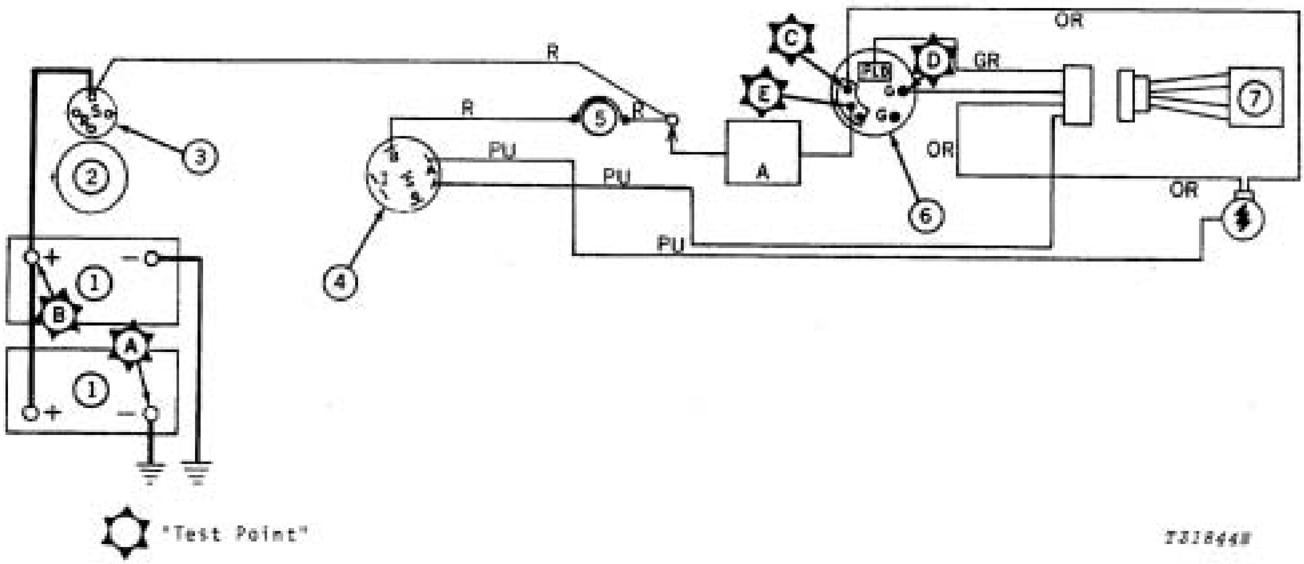
Connect voltmeter with ± 0.1-volt accuracy to the alternator output terminal and ground terminal (Fig. 20). With charged batteries and the regulator brought to operating temperature (fifteen minutes operation), the voltage should be as specified for the surrounding air temperature. See chart below. If battery is partially discharged, it may be necessary to connect a 1/4-ohm resistor in series with the ammeter.

Regulator Voltage (After Fifteen Minutes Operation At 1500 rpm)

Temperature*	Voltage
40°F [4.4°C]	14.4 - 14.9 volts
60°F [15.6°C]	14.3 - 14.7 volts
80°F [26.7°C]	14.2 - 14.6 volts
100°F [37.8°F]	14.0 - 14.4 volts
120°F [48.9°C]	13.8 - 14.3 volts
140°F [60.0°C]	13.6 - 14.1 volts

*Measured one inch from regulator.

If voltage is not within the limits in the above chart, stop engine and with key switch off, replace the regulator. If voltage with new regulator is not correct, the difficulty must be in the sytem wiring or the isolation diode.



1—Batteries
2—Starting Motor
3—Solenoid
4—Key Switch
5—Circuit Breaker
6—Alternator
7—Regulator

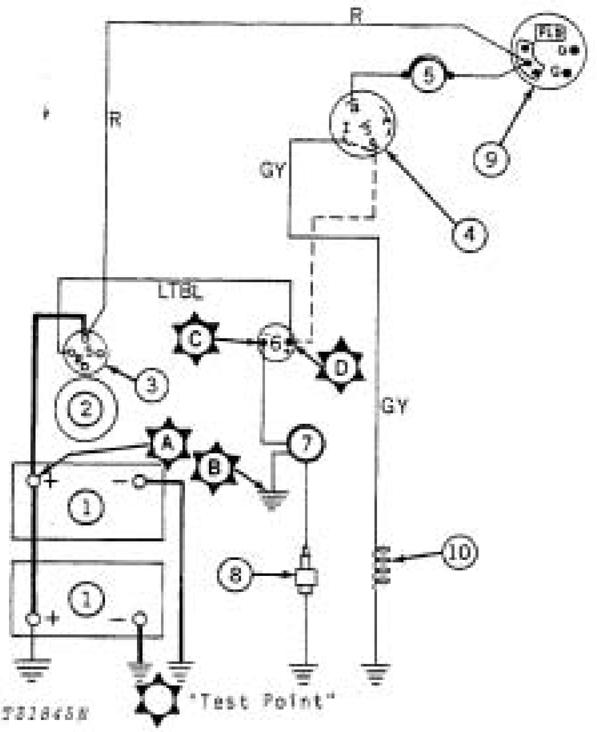
Fig. 24-High Resistance Test Points

With battery ground disconnected, connect the ammeter (Fig. 24). Obtain 10-amp charge rate. Check the voltage between the indicated points. Use a pin connector at the battery post. High resistances are usually caused by a poor connection.

Test Points	Maximum Voltmeter Reading
A - D	0.3 volt
B - E	0.3 volt
B - C	1.3 volts

**10-amp charging rate*

Testing the Ignition Circuit



1—Batteries
2—Starting Motor
3—Solenoid
4—Key Switch
5—Circuit Breaker
6—Coil
7—Distributor
8—Spark Plug
9—Alternator
10—Fuel Shut-Off Solenoid

Fig. 25-Ignition Circuit Test Points

Testing For High Resistance, Open Circuits Or Grounds

Check for open circuits, grounds, or high resistance on points indicated in Fig. 25. Make test with lights and accessories turned off and use a pin connector on the battery post. Disconnect and ground wire from coil to distributor.

Voltmeter Connected To	Ignition Switch Position	Breaker Points	Voltmeter Reading
A - D	Cranking	---	1 Volt Max
B - D	Cranking	---	Approx. 10 Volts
B - D	On	Open	Battery Voltage
B - D	On	Closed	Approx. 4.8 Volts
B - C	On	Closed	0.2 Volt Max.

High Voltage A to D (Cranking)

Open circuit between battery and coil
Ignition switch not closing circuit
Ground in coil

Low Voltage B To D (Cranking)

Low battery
Contact points not opening
Open circuit between coil and distributor
Defective or improperly adjusted contact finger at solenoid "R" terminal

Low Voltage B To D (Points Open)

Open circuit between battery and coil
Shorted condenser

Low Voltage B To D (Points Closed)

Poor connection
Open resistance wire
Grounded coil primary

High Voltage B To D (Points Closed)

Loose connection in distributor
Poor distributor ground to engine
Dirty or burned distributor contact points
Loose connection between coil and distributor
Resistance wire shorted out of circuit or short at "R" terminal

High Voltage B To C (Points Closed)

Poor connection in distributor
Poor ground from distributor to engine
Dirty or burned distributor contact points

Carburetor And Injection Pump Solenoid

The carburetor and injection pump solenoid windings may be checked for resistance or current consumption. The solenoid terminal connection should be clean and tight.

INJECTION PUMP SOLENOID WINDING
Winding current draw .... Approx. 2.5 amps
Winding resistance .... Approx. 5 ohms
Voltage required to energize .... Approx. 8 volts

CARBURETOR SHUT-OFF SOLENOID
Winding current draw .... Approx. 0.6 amp
Winding resistance .... Approx. 20 ohms
Shut-off needle opens .... 4 to 6 volts

Timing the Distributor

Timing Light Method

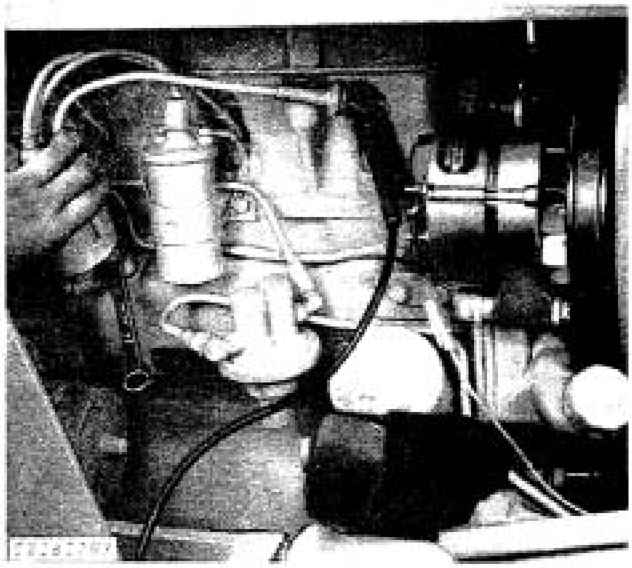


Fig. 26-Timing the Distributor with a Timing Light

Connect timing light according to manufacturer's instructions to No. 1 (front) spark plug cable (Fig. 26). Run engine at 2500 rpm. Loosen distributor clamp and rotate distributor until spark occurs when mark on crankshaft front pulley lines up with mark on engine casting. Tighten clamp when timing is correct.

Emergency Timing Method

For emergency timing procedures only, without a timing light, install the distributor as described in INSTALLATION (Section 30, Group 20) except for the dust cover, rotor, and cap.

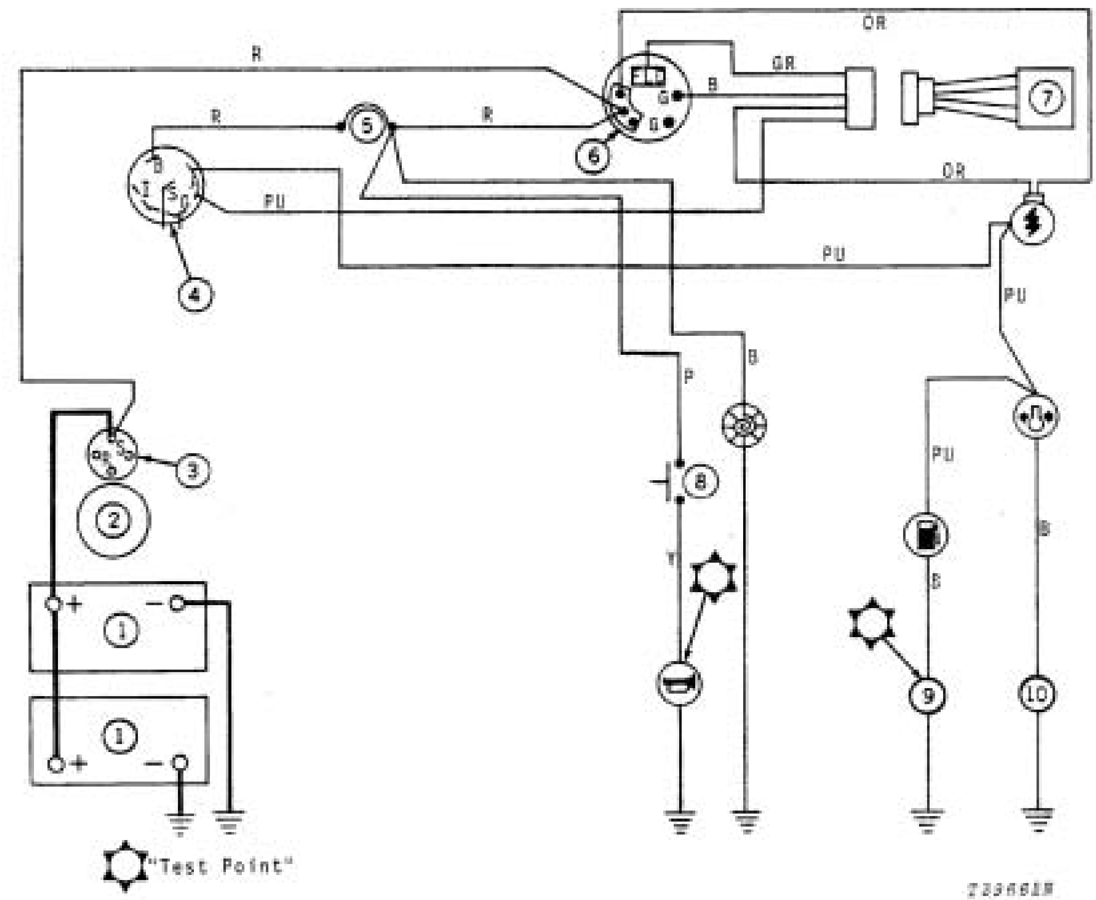
Remove spark plugs. Place thumb in No. 1 spark plug hole and turn engine until considerable pressure is felt against thumb. Continue turning engine until mark on crankshaft front pulley lines up with mark on engine casting. If mark goes past mark on engine casting, back engine up at least 1/4 turn to remove timing gear backlash and then turn engine until mark is lined up.

Remove coil-to-distributor high-tension wire from distributor and place terminal end 1/8 inch [3.175 mm] from grounded part of the engine. Turn the key switch on.

Turn rotor counter-clockwise as far as possible. Hold rotor in this position and rotate distributor body slowly until the points are just beginning to open. This is indicated by a spark between high-tension wire and ground. Be sure points are just beginning to open and are not just closing. Recheck timing after tightening clamp.

Install dust cover, rotor, distributor cap, and spark plugs. Install all cables, being sure they make good contact at distributor, at spark plugs, and at coil terminals. See that the spark plug cable boots and nipples are properly positioned.

NOTE: This timing will vary with distributor drive gear backlash and it is highly recommended to use a timing light to accurately time the distributor.



1—Batteries
2—Starting Motor
3—Solenoid
4—Key Switch
5—Circuit Breaker
6—Alternator
7—Regulator
8—Horn Switch
9—Sending Unit
10—Sending Unit

Fig. 27-Accessory Circuit

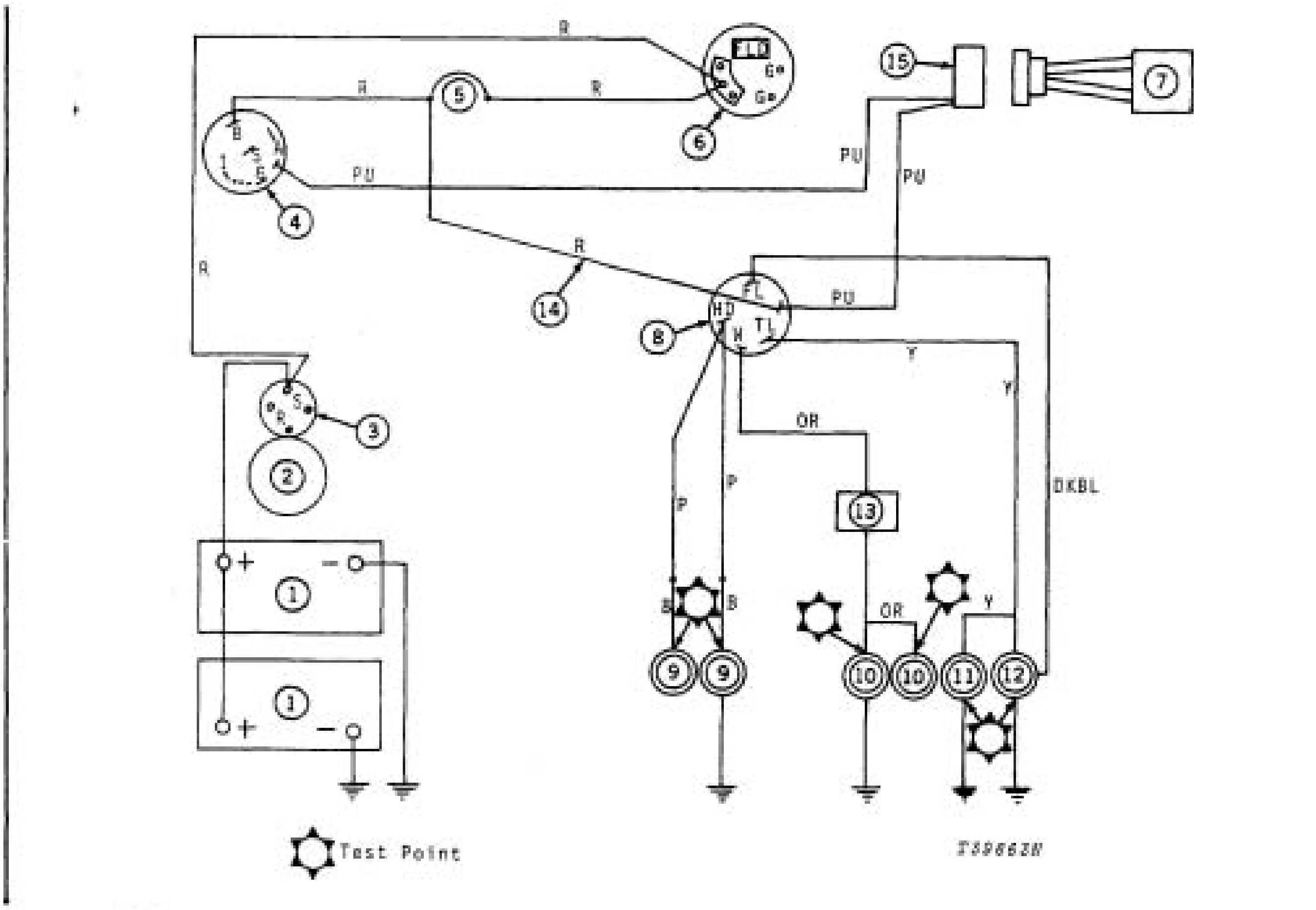
Fuel Gauge

Fuel gauge receiver is balancing-coil type and fuel gauge sender has 30 ohms resistance with 0 ohms at EMPTY. The receiver may be checked with an ohmmeter, commercial tester, or another 30-ohm sender. Connect sender at the tank first, then if necessary, at the receiver. Check receiver and sender for adequate ground with a voltmeter. Additional information is in FOS Manual 20—ELECTRICAL SYSTEMS.

Horn

Current draw at 12 volts is 4.5 to 5.5 amps. Ammeter reading of 20 amps indicates points are not opening. Turn adjusting screw to adjust current draw and frequency.

Testing the Light Circuit



1—Batteries
2—Starting Motor
3—Solenoid
4—Key Switch
5—Circuit Breaker
6—Alternator
7—Regulator
8—Light Switch
9—Front Headlights
10—Warning Lamp
11—Electrical Outlet
12—Combination Flood and Taillight
13—Flasher
14—Alternate Power Lead to Light Switch
15—Regulator Connector

Fig. 28-Lighting Circuit

The light switch is energized by the key switch "ACC" terminal through a purple wire that goes to the regulator connector and then on to the light switch. In order for the lights to work the key switch must be in the "ACC" or "IGN" position.

To by-pass the key switch, remove the purple wire from the light switch "BAT" terminal and install the red wire (14).

Connect voltmeter to lamp terminal and lamp frame.

Voltmeter Reads Battery Voltage

Defective bulb
High resistance at an internal connection

If voltmeter reading is 0.5 volt or more below battery voltage, connect voltmeter between lamp frame and a good ground.

Voltmeter Reading Exceeds 0.1 Volt

Defective lamp ground.

If voltmeter reading to ground is lower than 0.1 volt, connect voltmeter between lamp terminal and battery positive post that is connected to the starting motor.

Voltmeter Reading Exceeds 0.5 Volt

Defective light switch or key switch.
Defective or disconnected wiring.

If voltage is excessive, use voltmeter across various points between the lamp terminal and the battery post to locate the point of excessive resistance. Individual unit resistance should not exceed 0.1 volt.

If voltmeter reading is under 0.5 volt between lamp terminal and the battery post, connect voltmeter to lamp frame and the grounded battery post. A voltage reading above 0.5 volt indicates there is a high resistance somewhere in the ground circuit. Connect the voltmeter across various places where a high resistance might be present such as a fender mounting to the tractor frame.

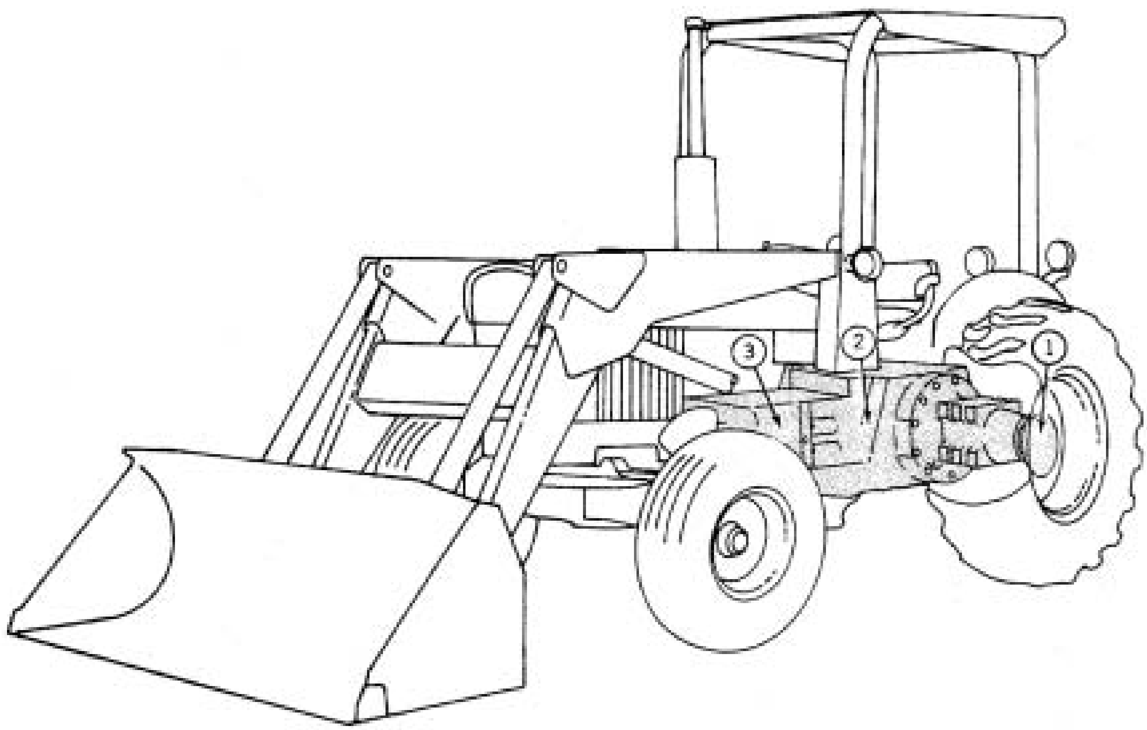
Adjustment

Position the tractor so the lamp is 25 feet [7.60 m] from a wall. With the light switch in the "H" position, the high intensity light beams should shine straight forward from the lamps and be equal distances from the tractor center line. The upper edge of each high intensity beam should be at least 5 inches [127.0 mm] below the center of the light from which it comes.

Adjust the lamps so they never cause glare to the driver of an approaching vehicle.

Group 20
POWER TRAIN

GENERAL INFORMATION



T31915N

1—Final Drive
2—Transmission and Differential Case
3—Reverser or Clutch Housing

Fig. 1-Power Train Components Location

Clutch Assemblies

Single Stage

A single-stage clutch is used on all tractors except those equipped with continuous-running PTO.

The assembly is attached to the rear of the engine flywheel and consists of a single spring-loaded, dry disk-type clutch with friction facings riveted or bonded to either side of the driven disk.

When the clutch pedal is depressed (disengaged), the clamping action of the pressure plate is released, disengaging the clutch-driven disk from the pressure plate and flywheel.

When the clutch pedal is released (engaged), coil springs within the pressure plate mechanism act against the pressure plate disk and clamp the friction surfaces of the driven disk between the pressure plate and the clutch surface of the flywheel. The clutch-driven disk then starts rotating with the pressure plate assembly and flywheel to transmit engine power to the transmission.

The clutch and clutch control linkages are designed so that minor adjustment of the clutch is made externally, eliminating disassembly of the clutch except at time of major overhaul.

Dual Stage

A dual stage clutch is used when unit is equipped with continuous-running PTO. The assembly contains a single stage engine clutch mounted against the flywheel and a single stage PTO clutch mounted in tandem with the engine clutch. Each consists of a dry disk-type clutch with friction facings bonded or riveted to the driven disks. When in engaged position, the engine clutch friction facings contact the rear surface of flywheel and clutch plate. PTO clutch facings contact the powershaft clutch plate and clutch cover.

The engine clutch or front clutch supplies engine power to the transmission through the transmission clutch shaft. PTO clutch or rear clutch supplies power to the power take-off.

The engine clutch is disengaged by depressing the clutch pedal to the first operating position (approximately 3/4 way down). This forces the throwout bearing against the clutch operating levers which retract the engine clutch plate through the operating bolts. This action releases the engine clutch disk from the driving surface of the flywheel and interrupts the flow of power to the transmission.

When the clutch pedal is released, coil springs within the dual stage clutch mechanism clamp the friction surfaces of the driven disk between the clutch plate and the clutch surface of the flywheel. This causes the driven disk to rotate with the clutch assembly and engine flywheel, thereby transmitting engine power to the transmission.

The PTO clutch is disengaged by completely depressing the clutch pedal. This forces the throw-out bearing against the clutch operating levers which first retract the engine clutch plate; then, as the operating levers move farther they retract the PTO clutch plate through the release pins. This action releases the PTO clutch disk from the driving surface of the clutch cover and interrupts the flow of power to the PTO drive shaft.

When the clutch pedal is released, coil springs within the dual stage clutch mechanism act against the PTO clutch plate and clamp the friction surfaces of the driven disk between the clutch plate and the clutch surface of the clutch cover.

This causes the driven disk to rotate with the clutch assembly and engine flywheel, transmitting engine power to PTO drive shaft.

Transmission

The transmission is a collar shift type using helical gears. Two shift levers manually select four gears in each of three ranges (two forward and one reverse). This provides eight forward and four reverse speeds.

The transmission gear train is contained in a single compartment of the transmission case. The case also serves as the main oil reservoir for the transmission-hydraulics system. A gear-type oil pump in the front of the case forces oil through the transmission shafts to lubricate the gear train. The transmission also contains an oil cup reservoir which gravity-feeds oil to the transmission parts when the tractor is being towed.

The transmission gears are carried on three shafts—the transmission drive shaft, the differential drive shaft, and the countershaft (Fig. 2).

Transmission Drive Shaft

The transmission drive shaft is located at the top of the transmission. It operates as a solid unit comprised of the shaft and four gears which transmit power at various speeds from the countershaft to the differential drive shaft or directly to the differential drive shaft in high range.

Differential Drive Shaft

The differential drive shaft is located directly below the transmission drive shaft. Four driven gears are mounted on the differential drive shaft, and are selectively engaged to the shaft by means of two collar-type speed change shifters. Power is transmitted to the differential assembly by the bevel pinion at the rear of the differential drive shaft.

Countershaft

The countershaft is located to the left and slightly below the transmission drive shaft. It carries two range pinions (low and reverse) to provide low range shifting between the countershaft and the transmission drive shaft, and reverse range shifting between the countershaft and the differential drive shaft.

Input power is transmitted from the clutch shaft to the countershaft by a transmission drive gear which is located between the clutch shaft and the transmission drive shaft.

Shifter Controls

Transmission gears are selected manually by two shift levers mounted on top of the clutch housing. The range shift lever (left hand) is used to select low, high, or reverse ranges; a park position is also provided. The gear shift lever (right hand) can be used to select first, second, third, or fourth gears when the range shift lever is in low range position; it can be used to select fifth, sixth, seventh, or eighth gears when the range shift lever is in high range position. When the range shift lever is in reverse range, reverse gears comparable to first, second, third, or fourth can be obtained (- 277181).

A starter safety switch is provided. The range shift lever must be in neutral or in park (P) position before the engine can be started.

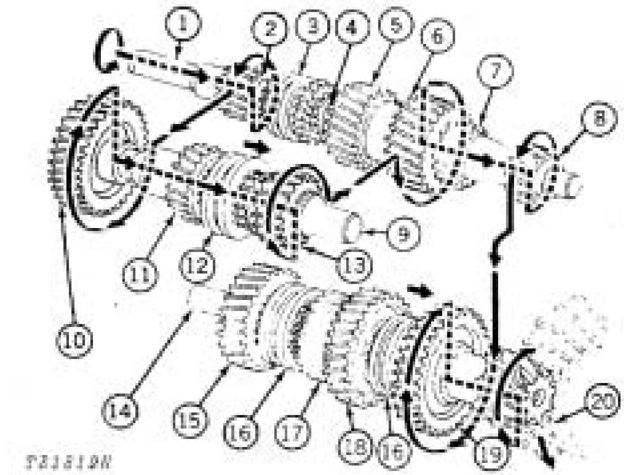
Park Position

Place the right hand shift lever in any gear and the left hand in park position. This locks the differential drive shaft to the transmission drive shaft and the transmission drive shaft to the drive shaft front quill which is secured to the transmission case.

Tow Position

Place both gear shift levers in neutral position.

Never tow the tractor at speeds greater than 15 mph [24.1395 km/h]. When towing the tractor to start it, never tow at speeds greater than normal for the gear the tractor is being started in. Tow the tractor only in sixth, seventh, or eighth gear at these times.



1—Clutch Shaft
2—Drive Gear
3—High Range Shifter Collar
4—Transmission Drive Shaft
5—Third and Seventh Speed Drive Gear
6—Fourth and Eighth Speed Drive Gear
7—Second and Sixth Speed Drive Gear
8—First and Fifth Speed Drive Gear
9—Countershaft
10—Countershaft Drive Gear
11—Reverse Range Pinion
12—Shifter Collar
13—Low Range Pinion
14—Differential Drive Shaft
15—Third and Seventh Speed Driven Gear
16—Shifter Collar (2 used)
17—Fourth and Eighth Speed Driven Gear
18—Second and Sixth Speed Driven Gear
19—First and Fifth Speed Driven Gear
20—Differential

Fig. 2-Collar Shift Transmission
(Power Flow in First Speed Illustrated)

The above illustrates the collar shift transmission parts. Gear combinations to obtain first gear are also shown.

Use the following chart and Figure 2 to trace power flow through the transmission when diagnosing problems in a particular operating gear. The drive gears and driven gears are listed by component numbers (see key to Fig. 2) in the sequence of power flow.

Gear	Power Flow (Fig. 2)
Forward	
1	1, 2, 10, 13, 6, 8, 19, 20
2	1, 2, 10, 13, 6, 7, 18, 20
3	1, 2, 10, 13, 6, 5, 15, 20
4	1, 2, 10, 13, 6, 17, 20
5	1, 2, 8, 19, 20
6	1, 2, 7, 18, 20
7	1, 2, 5, 15, 20
8	1, 2, 6, 17, 20
Reverse	
1	1, 2, 10, 11, 15, 5, 8, 19, 20
2	1, 2, 10, 11, 15, 5, 7, 18, 20
3	1, 2, 10, 11, 15, 20
4	1, 2, 10, 11, 15, 5, 6, 17, 20

Reverser

The reverser is a hydraulic and mechanical device which changes the direction of tractor travel under full load without shifting the transmission gears. A single compound planetary set of gears, a reverse brake, and one clutch are utilized to accomplish this type of directional shifting.

A "high-speed" lockout is provided in the reverser and transmission control mechanisms to allow reverse shifting only when the transmission is in low range.

NOTE: Units starting with S.N. (277182) will not have the high range reverse lockout.

Thus, four reverse speeds are provided, each approximately 16% faster than their respective forward low range speeds.

A single stage dry clutch is provided on the engine flywheel ahead of the reverser unit to disconnect the reverser during cold weather starting. It also serves as a PTO clutch if tractor is equipped with a power-shaft. The pedal control linkage is designed so that the reverser clutches are neutralized before the disconnect clutch is disengaged.

Refer to Section 70 Group 25 for the reverser hydraulic operation.

The reverser clutch housing contains two main functional units:

(1) Forward Clutch Assembly
(2) Reverse Brake Assembly

Forward Clutch Assembly

The forward clutch assembly consists of three sintered bronze clutch friction disks alternated with three steel separator plates. The disks and plates are "packed" on a clutch hub. Internal teeth on the disks mesh with teeth on the hub. The separator plates have external tangs fitting into slots on the clutch drum. To provide ready clutch release, the clutch separator plates have a "wavy" configuration.

The clutch pack is engaged by movement of a circular hydraulic piston. A spring washer pack releases the piston when the clutch pack is disengaged.

The forward clutch hub, drum, and separator plates are driven by the clutch drive shaft splined to the dry-type disconnect clutch. The clutch hub and disks are splined to the rear clutch shaft and rotate only when the clutch is engaged.

Reverse Brake Assembly

The reverse brake assembly is a hydraulic and mechanical device to reverse the flow of engine power to the transmission, without shifting gears. A hydraulic disk-type brake and a single compound planetary set act together to provide this type of tractor reversing.

The reverse brake unit consists of four sintered bronze friction disks alternated with four separator plates. The disks have internal splines in mesh with external teeth on the brake hub. The hub is splined to the planet sun pinion in the planetary set. The separator plates have external tangs in slots around the outside of the reverse brake housing. To aid in brake release, the separator plates have a "wavy" configuration.

The reverse brake is applied by means of a circular hydraulic piston. When the brake is disengaged, spring washers release the piston.

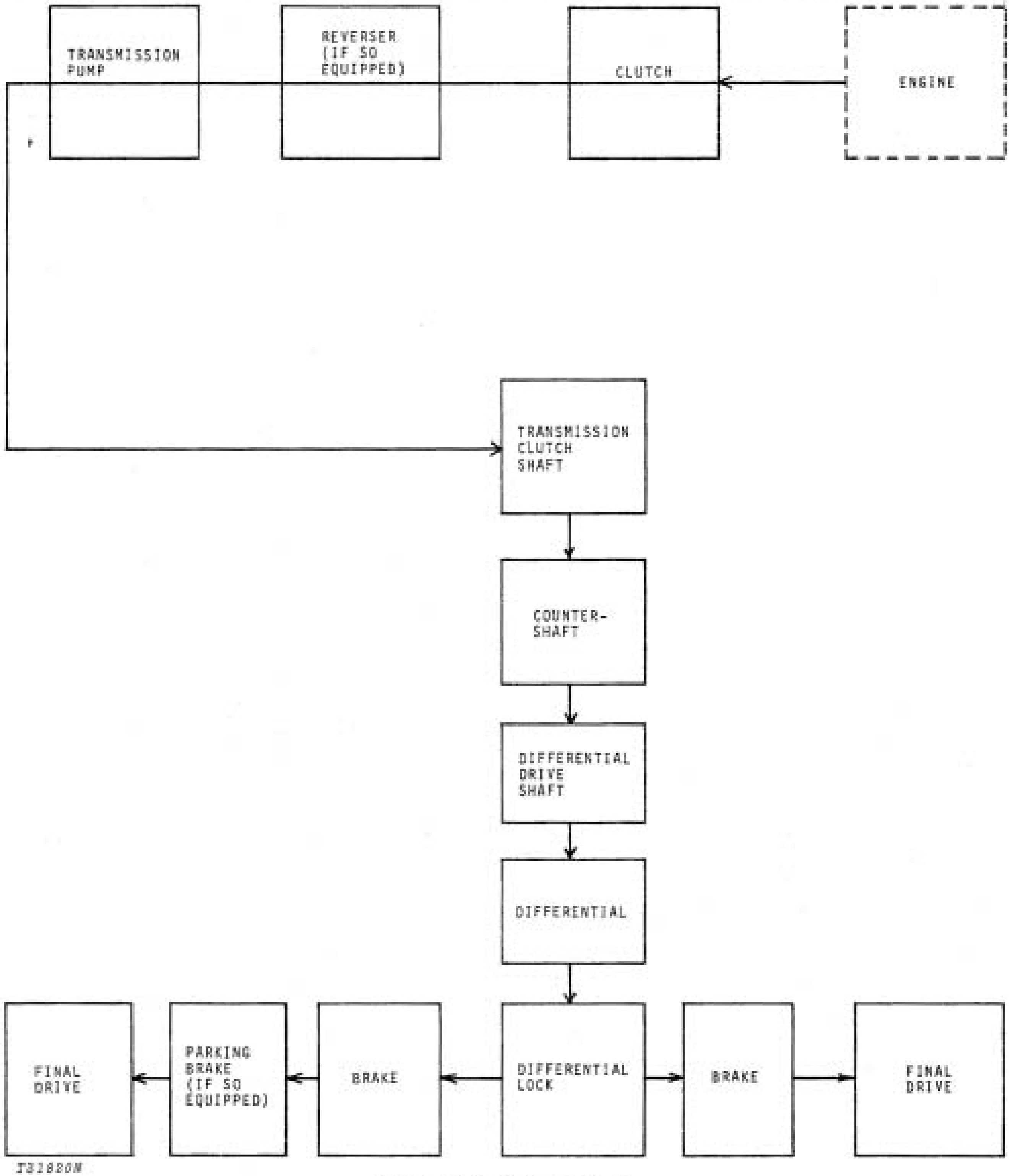
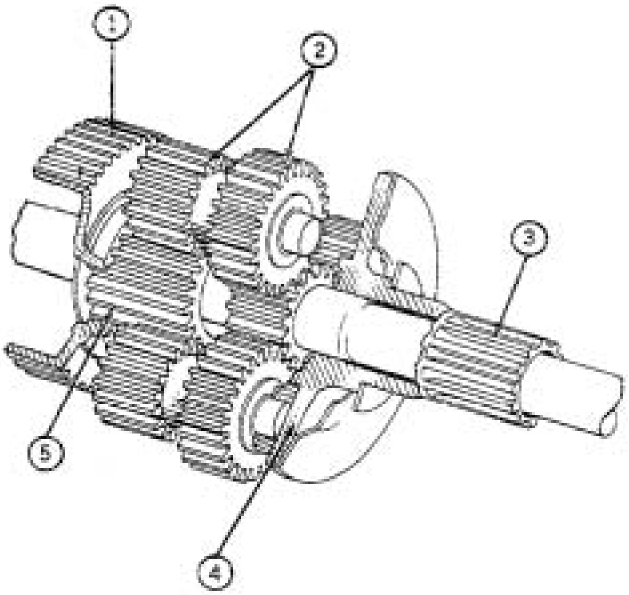


Fig. 3-Power Train Block Diagram



1—Reverse Brake Clutch Hub
2—Planet Pinion (3 used)
3—Carrier Drive Shaft
4—Planet Pinion Carrier
5—Planet Sun Pinion

Fig. 4-Reverser Planetary Set

The reverser planetary system consists of a planet pinion carrier with three planet pinions, a planet sun pinion, and a driven gear integral with the clutch shaft (Fig. 2). The planet pinions are made up of two gears on a single forging supported in the carrier by shafts and needle bearings. The largest gear (25 teeth), on the planet pinion is in mesh with the clutch shaft driven gear (17 teeth), while the smaller planet pinion gear (17 teeth) is in mesh with the planet sun pinion (25 teeth).

Continuous Running PTO

The continuous-running PTO is a single 540 rpm PTO. A mid 1000 rpm powershaft is available.

The PTO powershaft is located in the lower portion of the transmission case. Its operation is independent of the transmission and differential. The PTO has its own clutch and gear train, and runs only when the PTO clutch is engaged.

The PTO is equipped with selector levers to disconnect the rear or mid powershafts when the shafts are not in use or when indpendent operation of the shafts is desired.

Both selector levers are located on the left side of the tractor; the mid PTO selector lever is located just forward of the rear PTO lever.

NOTE: On tractors with reverser, all PTO options are continuous-running.

A dual stage clutch is used to provide continuous PTO operation on tractors not equipped with reverser. On tractors with reverser, a single stage clutch is used to provide continuous PTO operation.

Independent PTO

The independent PTO is a single 540 rpm PTO.

The PTO gear train is located in the lower portion of the transmission case. The PTO clutch shaft is driven by the engine clutch pressure plate (single stage) and turns the PTO clutch drum whenever the engine is running. Clutch shaft operation is independent of the transmission.

Operation of the PTO clutch (mounted ahead of transmission countershaft bearing support) is controlled by a control valve located at the top of the clutch housing in the transmission shifter cover.

Differential and Parking Brake

The differential is a spiral bevel gear assembly.

It is located in the rear compartment of the one-piece transmission and differential case.

The assembly is equipped with pedal-operated differential lock which consists of a collar to connect the left bevel gear to the housing. This locks the gears and pinions within the housing, giving the effect of a solid rear axle.

The parking brake drum is located within the differential case and is splined to the left hand differential housing.

Final Drives

Each rear axle assembly is mounted on two tapered roller bearings with oil seals and a planetary gear system which provides the final 5-to-1 speed reduction.

DIAGNOSING MALFUNCTIONS

Clutch Assemblies

The following malfunctions will apply to both single stage and dual stage clutches. Servicing for both sets of clutches is covered in this group.

Clutch Slips

Worn or burned clutch disk facings.
Replace clutch disk. Check pressure plate.

Oil or grease on clutch disk facings.
Clean or replace disk.

Insufficient clutch pedal free travel.
Adjust pedal linkage.

Release levers out of adjustment.

Clutch Grabs or Chatters

Broken damper clutch spring (diesel, with reverser only).

Clutch disk warped or bent.
Replace disk.

Loose clutch disk facings.
Replace clutch disk.

Disk facings dirty or gummed.
Clean or replace disk.

Clutch disk loose at hub.
Repair disk and shaft.

Clutch disk hub tight on shaft.
Repair disk and shaft.

Tight or binding clutch fork shaft.

Cracked or broken pressure plate.

Pressure place sticking.

Weak clutch springs.
Check springs to specifications.

Excessive transmission backlash.
Repair transmission.

Worn clutch throw-out bearing.
Replace and lubricate periodically.

Clutch Makes Noise (While Engaged)

Broken damper clutch spring (diesel, with reverser only.)

Clutch disk warped or bent.
Replace disk.

Clutch shaft or disk splines worn.
Replace shaft and disk.

Clutch disk loose at hub rivets.
Replace disk.

Flywheel loose on crankshaft.

Clutch Drags

Distorted or rough clutch shaft splines.
Repair or replace shaft and disk.

Disk hub tight on clutch shaft.
Repair or replace shaft and disk.

Disk facings broken.

Clutch disk warped or bent.

High spots on disk.

Excessive pedal free travel.
Adjust pedal linkage.

Excessive clutch face run-out (flywheel not seated properly).

Clutch disk frozen to flywheel.
Clean or replace disk.

Clutch Pedal Pulsates

Broken or missing clutch pedal spring.
Replace spring.

Release levers out of adjustment.
Adjust levers.

Flywheel not seated correctly.
Remove and seat correctly.

Bent crankshaft flywheel flange.
Replace crankshaft.

Bent clutch shaft.
Replace shaft and disk.

Transmission

Excessive Gear Clash When Shifting

Attempting to shift too fast.
Slow down shifting.
Shifter worn or broken.
Replace shifters.
Engine clutch dragging.
Adjust clutch pedal (70-20-10).
Engine clutch not fully disengaging.
Adjust clutch linkage.
Gears rotate with clutch pedal depressed.
Repair failed snubber brake.

Excessive Transmission Noise

Parts worn or damaged.
Repair transmission.
Transmission low on oil.
Fill to specified level.
Transmission oil pump not functioning.
Inspect and repair pump.

Reverser

Shifts Too Slowly

Refer to Section 70, Group 25.

Shifts Too Fast

Refer to Section 70, Group 25.

Jumpy Clutch Engagement When Inching Tractor

Refer to Section 70, Group 25.

Clutch or Brake Slips Under Load

Refer to Section 70, Group 25 for Clutch Control Valve Test. Next perform "Engine Stall Test," page 70-20-11.

Transmission Gears Fail to Stop When Clutch Pedal is Depressed

Check dry-type disconnect clutch for correct wear adjustment. See page 70-20-10. Also refer to Clutch Control Valve Test (Section 70, Group 25).

Check for warped clutch disks or broken clutch piston return spring washers if this occurs in only forward or reverse and not in both.

If this condition occurs in both forward and reverse, and clutch pressure returns to zero (see Section 70, Group 25) when clutch pedal is depressed, check the transmission friction plug.

If transmission friction plug is not the cause of difficulty, "tee" a pressure gauge into the cooler return line and check operation of lubrication oil pressure reduction valve. When clutch pedal is depressed, pressure gauge should reflect 8 to 10 psi [0.005624 to 0.007030 kg/cm^2] lubrication oil pressure. (See Section 70, Group 25).

Continuous Running PTO

PTO Shaft Won't Turn

Engine clutch damaged.
Refer to page 40-5-9.
PTO clutch shaft or shafts broken.
PTO disconnect not engaged.
PTO drive gear or driven gears damaged.
Drive shaft spring broken or damaged.

Independent PTO

Noisy PTO

Bearings failed or worn.
Gear train damaged or worn.
Transmission oil supply low.
Engine slow idle below specified rpm.

No or Low Oil Pressure

See Section 70, Group 25.

Pressure Overlap

See Section 70, Group 25.

PTO Fails To Operate

Clutch facing worn or damaged.
PTO disconnected.
Engine clutch pressure plate defective.

Differential

Excessive Noise
(Continuous)

Worn bearing.
Damaged or worn gears.
Loss of lubricant.

(Under Load)

Worn bearings.
Bearing preload out of adjustment.
Ring gear backlash out of adjustment.

No Differential Action

Bevel pinions worn or damaged.

Differential Will Not Lock

Lock pedal turning on shaft.
Lock collar splines worn or damaged.
Bevel pinions worn or damaged.

Final Drives

Excessive Noise

Worn final drive shaft and sun pinion.
Damaged final drive gear.
Worn planet pinion bearing rollers.
Axle bearings damaged.
Insufficient amount of lubricant.

Axles Won't Turn

Broken rear axle.
Brake disk cocked.
(Refer to page 40-30-4).
Broken planetary gears or shafts.

Loss of Lubricant

Worn or broken oil seal.
Housing gasket broken.

VISUAL INSPECTION

Much can be learned about the general condition of the power train by visual inspection.

For example, if the power train is losing too much fluid, this can mean an external leak.

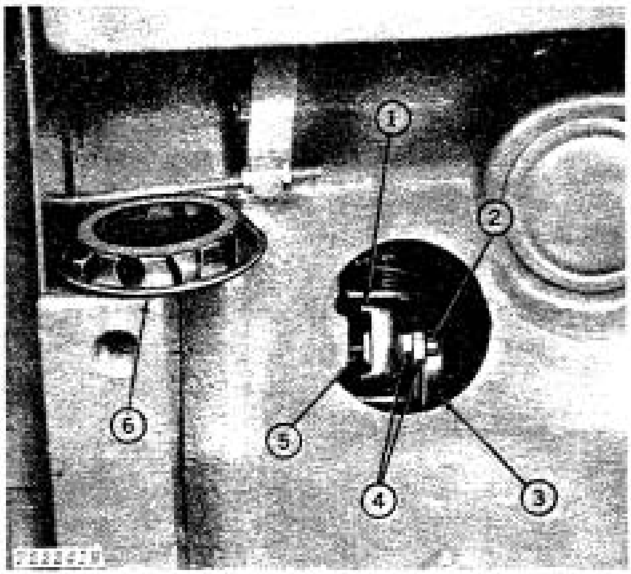
Check for the following conditions:

1. Improper cap screw torque.
2. Cracked or broken housing.
3. Failed gasket.
4. Worn or improperly installed oil seals and/or O-rings.

TESTING AND ADJUSTMENTS

Clutch Assemblies

Disconnect external clutch pedal linkage at clutch operating rod yoke. Remove access cover from left side of clutch housing.



1—Operating Lever
2—Operating Bolt
3—Throw-out Bearing
4—Jam Nuts
5—Clutch Plate Pins
6—Access Cover

Fig. 5-Adjusting Clutch Operating Levers

Loosen the three clutch operating bolt nuts until the clutch operating lever contacts the powershaft clutch plate pins (Fig. 5).

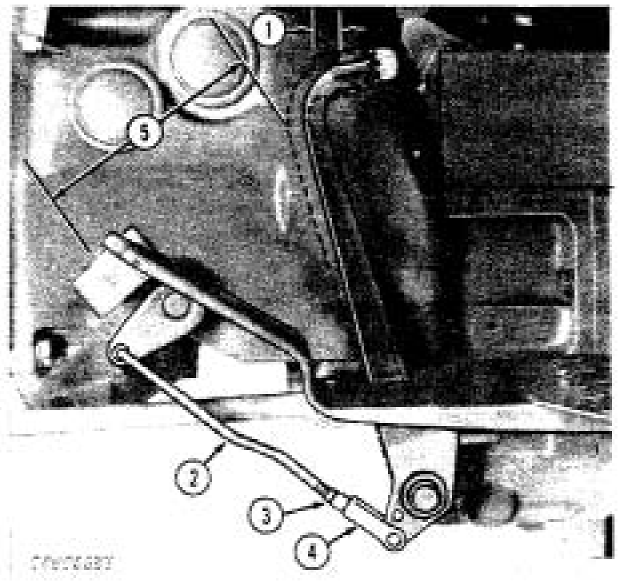
Rotate flywheel to gain access to each of the three operating bolt nuts through hole in clutch housing.

Tighten one clutch operating bolt nut 2-1/2 turns.

Adjust the external pedal linkage at clutch operating rod yoke to move the clutch throw-out bearing into initial contact with the adjusted clutch operating lever.

Readjust the remaining two clutch operating levers so that they lightly contact the clutch throw-out bearing, then tighten lock nuts.

Adjusting Clutch Pedal Free Travel (Units Without Reverser and Continuous PTO)



1—Specified Free Travel
2—Clutch Rod
3—Jam Nut
4—Yoke
5—5 In. (127 mm)

Fig. 6-Free Travel Without Reverser

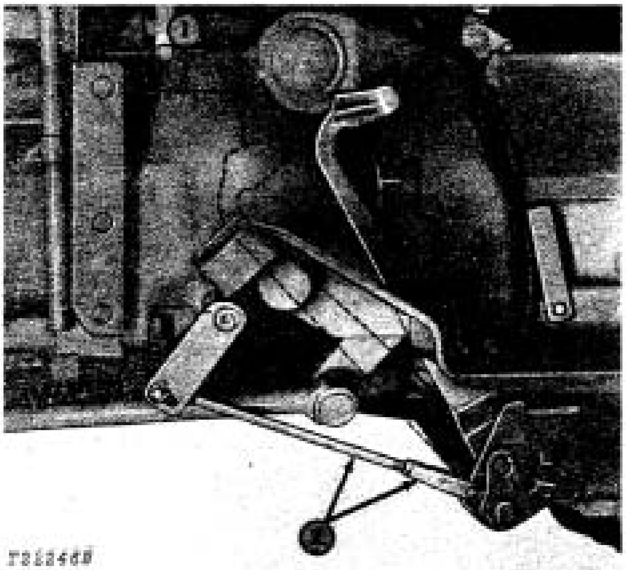
Adjust the clutch operating rod to obtain 1-inch (25.4 mm) free travel measured at the pedal pad (Fig. 6).

Without Reverser (With Independent PTO or With No PTO)

Push down the clutch pedal until the clutch fingers contact the throw-out bearing. Measure the distance from the pedal arm to where the arm hits the pedal stop. This distance must be 5 in. (127 mm) (5, Fig. 6).

If adjustment is needed, turn the yoke (4) of the clutch rod until the distance is 5 in. (127 mm).

Adjusting Clutch Pedal Free Travel (Units With Reverser)



1—Specified Dimension 5-1/4-inch (133.350 mm)
2—Pedal Adjusting Rod and Yoke

Fig. 7-Adjusting Clutch for Wear

Depress the pedal to the bottom of the first stage detent (where throw-out bearing contacts clutch fingers).

At this position, adjust the pedal rod to obtain the specified distance 5-1/4-in. (133.3 mm), measured from the rear or face of clutch pedal pad to the front of the clutch housing-to-engine bolting flange (Fig. 7).

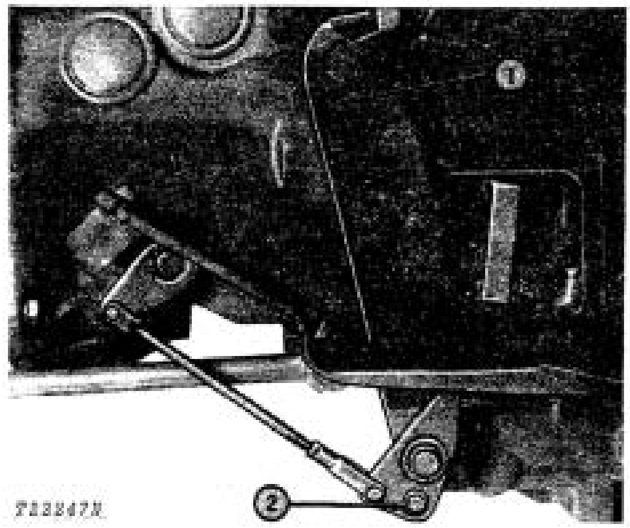
Clutch Pedal Position Adjustments

Positioning Clutch Pedal on Tractors with No PTO

To position the clutch pedal for proper operation of the clutch, loosen the clutch pedal positioning cap screw and depress the clutch pedal until the cap screw contacts the rear of slot in clutch pedal arm (Fig. 8).

Positioning Clutch Pedal On Tractors with Continuous-Running PTO

(1) For PTO Operation
To position the clutch pedal for proper operation of the PTO clutch, loosen the clutch pedal arm-to-clutch pedal cap screw and pull rearward on pedal until cap screw contacts front of slot in clutch pedal arm (Fig. 8).



1—Clutch Pedal
2—Pedal Positioning Cap Screw

Fig. 8-Positioning Clutch Pedal

(2) For PTO Lockout
When there is no requirement for PTO operation for long periods of time, the continuous-running PTO clutch may be locked out to save wear on the clutch and for better positioning of the clutch pedal.

To do this, loosen the pedal positioning cap screw and depress the clutch pedal until the cap screw contacts rear of slot in clutch pedal arm (Fig. 8).

Reverser

Engine Stall Test

Check clutch pressure as described under "Clutch Control Valve Test", Section 70, Group 25.

Perform "Engine Stall Test" as follows:

1. With engine running, engage the clutch pedal with the reverser lever in the forward position until the tractor moves.

2. Depress the clutch pedal, lock the brakes, place the transmission in 8th gear, run the engine at fast idle and engage the clutch. The engine must stall in 5 seconds maximum after the clutch pedal is released.

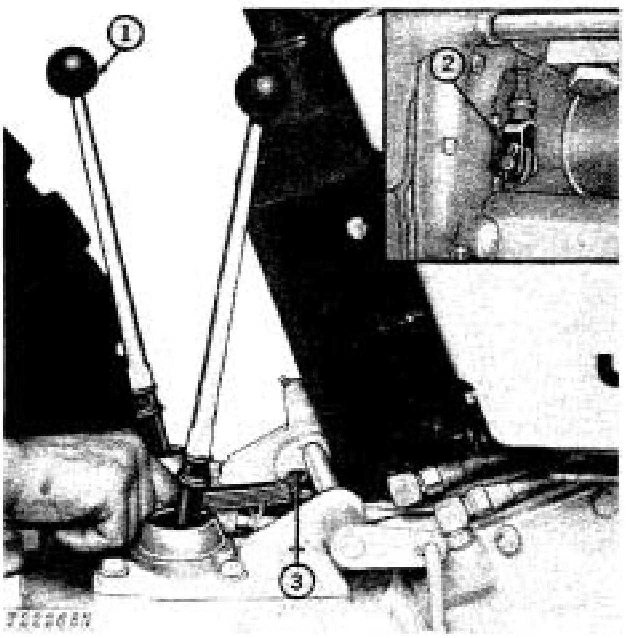
3. Repeat the stall test with the reverser lever in the reverse position and the transmission in 4th gear.

If the engine stall cannot be achieved in the preceding tests, with the reverser system pressure set at 145 to 155 psi [10.19 to 10.90 kg/cm²], a malfunction in the reverser clutches or control valve is indicated.

Also perform the ENGINE STALL TEST after servicing any components in the reverser assembly.

Adjusting High Speed Lockout Pin Clearance (-277181)

Place the transmission range shifter lever in the high range position.



1—In High Range
2—Adjusting Yoke
3—Feeler Gauge

Fig. 9-Measuring High Speed Lockout Pin Clearance

Move the reverser control lever to the neutral position. With a feeler gauge, check the clearance between the control shaft arm and the side of the high speed lockout pin (Fig. 9). Lengthen or shorten the reverser control lever rod to provide 0.040 in. (1.02 mm) clearance (inset, Fig. 9).

Refer to Section 70, Group 25 for hydraulic testing and adjustments.

Adjusting Reverser Neutral Lock Position (-277181)

After adjusting high speed lockout pin clearance, adjust the reverser neutral lock.

Refer to Fig. 6, Section 40, Group 15 for location of parts.

Move transmission control lever (12) backward and forward to locate the neutral detent position. Position lever in neutral position.

1. Remove cotter pin (16) and headed pin (17). Loosen jam nut (14) and lengthen or shorten link (39) by turning adjustable yoke (15) until neutral latch (2) fits over pin on dash. Tighten nut. Replace pin and cotter pin.

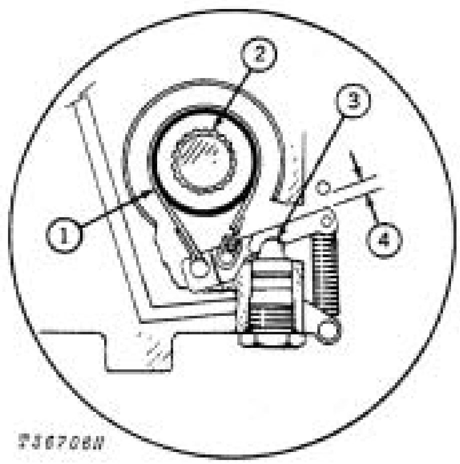
2. With neutral latch down, reverser must not engage.

3. With neutral latch up and transmission in high range, reverser must not engage reverse. If reverser does engage, reverse adjust the control lever rod (21) 1/2 turn counterclockwise. (Items 1, 2 and 4 must be rechecked after correction.)

4. With neutral latch up and reverser in neutral, abruptly place transmission in high range. If reverser engages forward, adjust the control lever rod (21) 1/2 turn clockwise. (Items 1, 2 and 3 must be rechecked after correction.)

Independent PTO Brake

To adjust the PTO brake proceed as follows: Using a fixture to pilot the transmission front bearing support and the powershaft brake band, adjust the band so that applying a force of 45 to 55 lbs. (20.41 to 24.95 kg) to the return spring end of the lever, will provide 0.31 to 0.50 in. (7.87 to 12.70 mm) clearance between the powershaft brake operating lever and the lever stop pin in the bearing support.

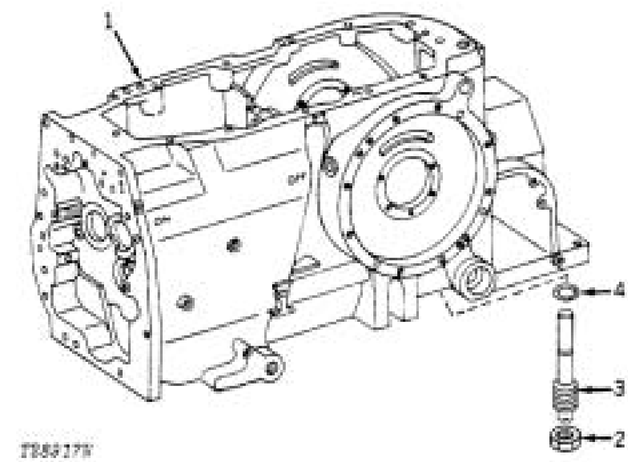


1—Brake Band
2—PTO Powershaft
3—Brake Piston
4—Clearance Dimension 0.31 to 0.50 in. [7.9 to 12.7 mm] PTO Brake

Fig. 10-Adjusting PTO Brake

Differential and Parking Brake

Set brake lever so that pawl (5, Fig. 5, page 40-25-5) is in first notch above long tooth. Hand tighten brake adjusting set screw (25).



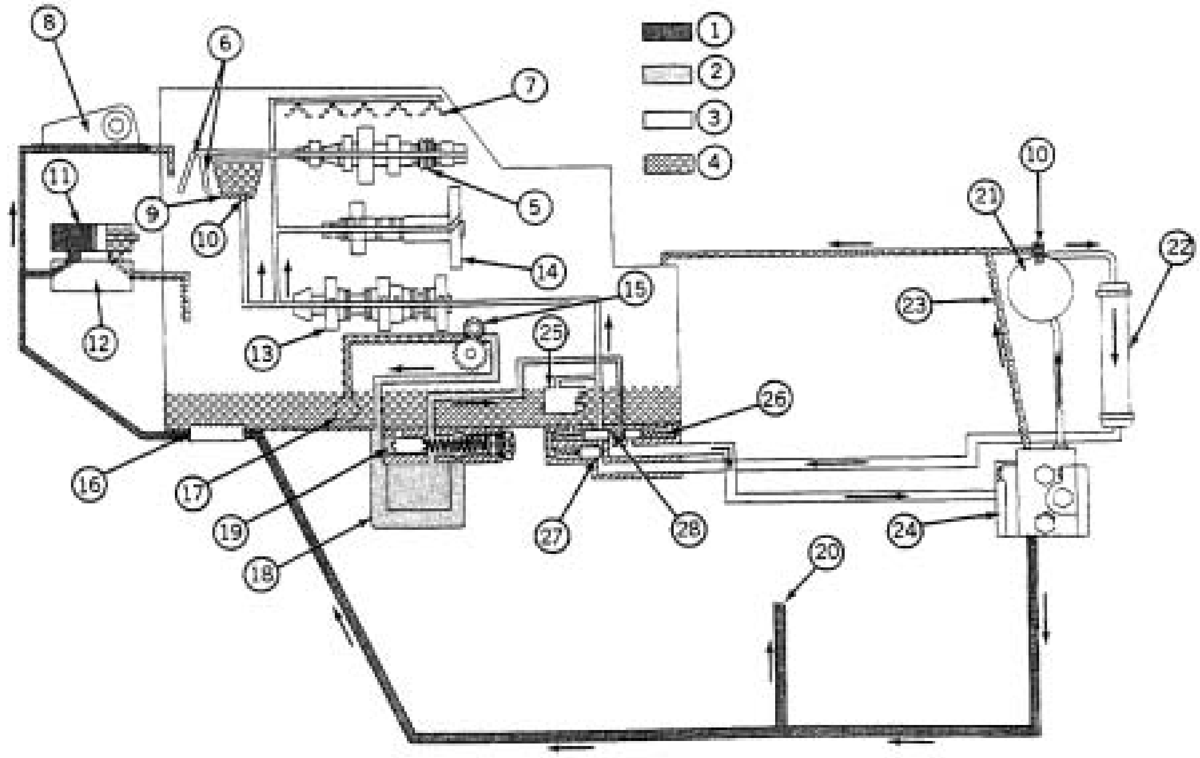
1—Transmission Case
2—Jam Nut
3—Brake Band Stop Screw
4—O-Ring

Fig. 11-Brake Band Stop Adjustment

Loosen jam nut (2, Fig. 11) on bottom left side of transmission case. Tighten brake band stop screw (3) hand tight, then back off two turns. Tighten jam nut (2).

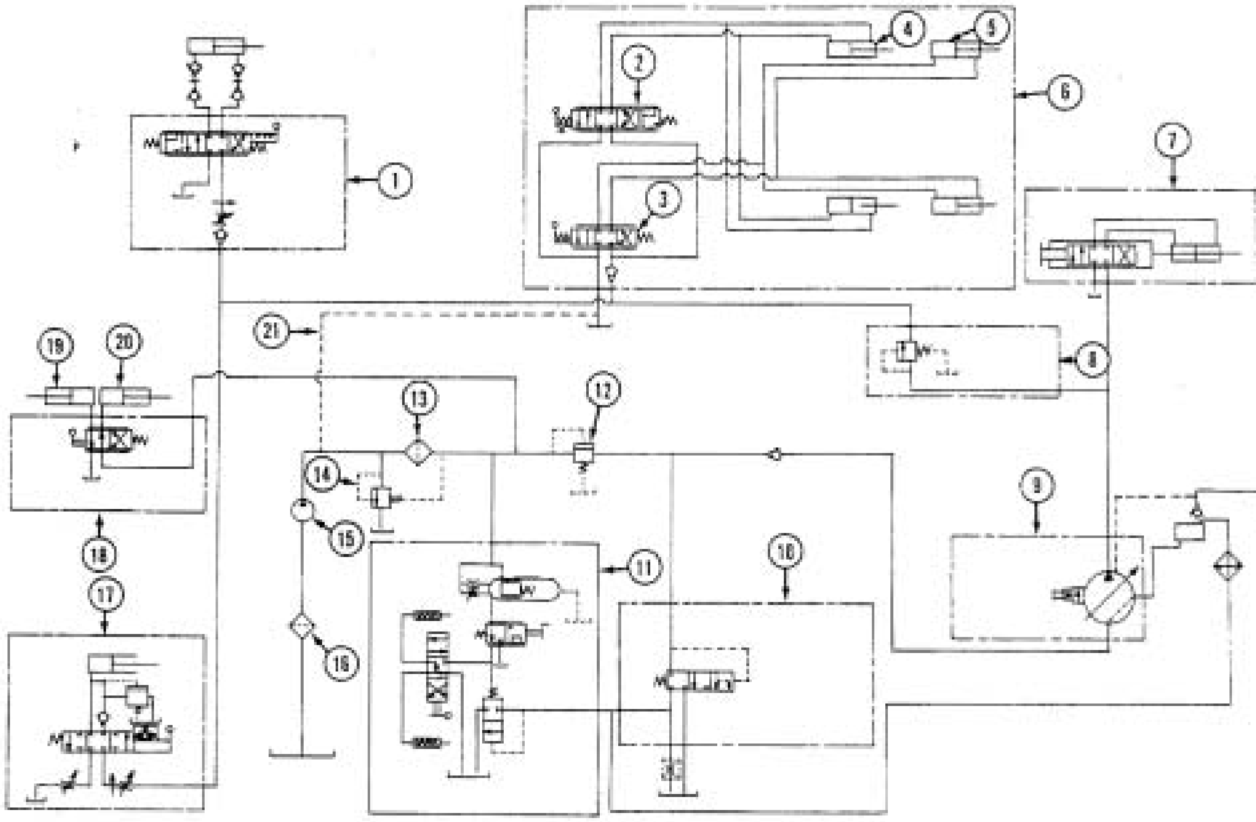
Group 25
HYDRAULIC SYSTEM

GENERAL INFORMATION



1—High Pressure Oil
2—Intermediate Pressure Oil
3—Low Pressure Oil
4—Pressure Free Oil
5—Transmission Drive Shaft
6—Lube to Final Drives
7—Transmission Oil Spray
8—Rockshaft
9—Transmission Oil Cup
10—Check Valve
11—Remote Cylinder
12—Selective Control Valve
13—Differential Drive Shaft
14—Countershaft
15—Transmission Oil Pump
16—Pressure Control Valve
17—Intake Screen
18—Transmission Filter
19—Relief Valve
20—To Power Steering Valve
21—Hydraulic Reservoir
22—Oil Cooler
23—Bleed Line
24—Main Hydraulic Pump
25—Brake Valve
26—Pressure Regulating Valve
27—Lube Reduction Valve
28—Cooler By-Pass Relief Valve

Fig. 1-Hydraulic System for Tractors Equipped with Reverser Unit



Z6884E

1—Selective Control Valve
2—Boom Section
3—Bucket Section
4—Boom Cylinders
5—Bucket Cylinders
6—Loader Circuit
7—Power Steering
8—Pressure Control Valve
9—Main Hydraulic Pump
10—Oil Cooler Bypass and Charge Relief Valve
11—Reverser Control Circuit
12—Pressure Regulating Valve
13—Transmission Filter
14—Oil Filter Relief Valve
15—Transmission Oil Pump
16—Intake Screen
17—Rockshaft
18—Independent PTO Control Valve
19—Clutch Cylinder
20—Brake Cylinder
21—Optional Return

Fig. 2-Hydraulic Schematic

The hydraulic system consists of the main oil reservoir (transmission case), transmission oil pump, main pump, relief and check valves, auxiliary hydraulic reservoir, oil cooler (tractors with reverser), rockshaft, and one or two selective control valves to operate remote cylinders.

The hydraulic system (Fig. 1) is of the closed-center, constant pressure type.

FOS See FOS Manual "HYDRAULICS" for additional description and theory of operation for hydraulic components.

Hydraulic Brakes

The hydraulic brake assembly is activated by two brake pedals, allowing individual or simultaneous operation of the hydraulic brake pressure plates located in annular cylinders in each final drive housing.

Braking is fully hydraulic with no mechanical connection between the valve and cylinders.

The brake valve reservoir is filled with oil by the transmission oil pump via the transmission lubrication circuit.

As long as there is oil in the brake valve reservoir, hydraulic braking is possible with the engine either running or stopped.

Power Steering

Pressure oil from the main hydraulic pump is supplied to the steering valve housing through a drilled passage in the housing.

When the steering valves are in neutral (steering wheel motion stopped) the valves are held on their seats by hydraulic and spring pressure so there is no oil flow to either side of the steering piston. (Thus the term "closed center" is used for this steering system.)

A mechanical force from the steering linkage can move the steering piston but a resultant hydraulic force will counteract any piston movement beyond 0.004 in. (0.102 mm).

Pressure Control Valve

The pressure control valve acts as a flow divider and maintains pressure for the hydraulic system. It gives priority to the steering system.

Reverser Clutch Control Valve

The reverser is a hydraulic and mechanical device which changes the direction of tractor travel under full load without shifting the transmission gears. A single compound planetary set of gears, a reverse brake, and one clutch are utilized to accomplish this type of directional shifting.

A "high-speed" lockout is provided in the reverser and transmission control mechanisms to allow reverse shifting only when the transmission is in low range.

Thus, four reverse speeds are provided, each approximately 16% faster than their respective forward low range speeds.

A single stage dry clutch is provided on the engine flywheel ahead of the reverser unit to disconnect the reverser during cold weather. It also serves as a PTO clutch if tractor is equipped with a powershaft. The pedal control linkage is designed so that the reverser clutches are neutralized before the disconnect clutch is disengaged.

NOTE: Units starting with S.N. (277182) will not have the high range reverse lockout.

Rockshaft System

The rockshaft with 3-point hitch will handle integral and semi-integral equipment with three types of control: load, depth, and load-and-depth.

When the system is set for depth control (selector lever in "D" position) the position of the rockshaft is always in direct relation to the position of the control lever on the quadrant.

In either load control ("L") or load-and-depth control ("LD") operation, the rockshaft control valve receives signals from the 3-point hitch draft links. The draft links are connected directly to the load control shaft positioned through the bottom rear of the transmission case on tapered bushings. Variation of pull on the draft link deflects the load control shaft. This deflection is picked up by the load control arm and transmitted to the rockshaft valve linkage.

The lowering speed of the rockshaft and equipment is regulated by the rate-of-drop screw located on the top of the rockshaft housing in front of the seat.

A relief valve in the rockshaft cylinder relieves thermal expansion of oil in the rockshaft assembly.

Independent PTO

Operation of the PTO clutch (mounted ahead of transmission countershaft bearing support) is controlled by a control valve located at the top of the clutch housing in the transmission shifter cover.

Selective Control Valve

The unit may be equipped with one selective control valve.

The selective control valve will operate single or double-acting cylinders and provides a full range of remote cylinder extending and retracting speeds.

The selective control valve is operated by a control lever which has four detented positions: (1) neutral; (2) extend; (3) retract; and (4) float.

The lever will detent in the selected position until the end of the cylinder stroke when it automatically returns to neutral. In float position, the lever must be manually unlocked.

Loader Control Valve

The loader control valve is a closed center, two spool valve.

The boom and bucket valve spools are contained in a single body. Lift checks are used which serve as one-way valves to prevent drift or leakage of pressure oil to the port passages.

DIAGNOSING MALFUNCTIONS

SYSTEM MALFUNCTIONS

Hydraulic Functions Slow

Slow hydraulic response.
Increase engine speed.

Oil not getting to main pump.
Clutch pedal in disengaged position.
Transmission pump not functioning properly.
Clogged transmission-hydraulic oil filter.

Improper oil in system.
Drain and fill system with proper oil.

Stroke control valve out of adjustment.
Check for foreign material or damaged seat.
Reset stroke control valve.

Internal leaks in functions.
Refer to systems tests to find leak.

Worn main hydraulic pump.
Test against specifications.

No Hydraulic Pressure

No oil in system.
Fill with proper oil.

Oil of wrong viscosity.
Check oil specifications.

Pump out of stroke.
Check pump shut-off screw.

Transmission pump not functioning.
Test against specifications.

External oil line leaks.
Tighten or replace.

Main pump worn or damaged.
Test pump against specifications.

Oil in System Heats

Wrong oil viscosity.
Use proper viscosity.

Oil in System Heats—Cont.

Low oil supply.
Check oil supply.

Oil cooler malfunctioning.
Clean or repair cooler.

Engine running too fast.
Reset to specifications.

Oil in System Foams

Kinks or dirt in line.
Clean or replace.

Low oil level.
Check oil supply.

Wrong viscosity of oil.
Drain and refill to specifications.

Water in oil.
Drain oil and check oil cooler for internal leaks.

MAIN PUMP MALFUNCTIONS

No Pump Output

Pump out of stroke.
Check pump shutoff screw.
Reset pump stroke control valve.
Stroke control valve stuck open.
Pump shaft broken.

Erratic Pump Operation

Stroke control valve not seating properly.
Check for foreign material or damaged seat.

Leaking inlet or discharge valve, defective O-rings.
Replace inlet and discharge valve; replace O-rings in stroke control valve housing.

Piston springs not balanced.
Check for broken springs or springs of unequal tension.

Pump piston(s) sticking.
Check for burrs or contamination on pistons. Replace parts if necessary.

Pump Noise or Squeal

Stroke control valve spring guide binding.
Dress down sharp bottom edge. Reset system pressure.

Loose drive coupling cap screws.
Tighten to specified torque.

Air trapped in stroke control valve oil cavity.
Relieve tension on stroke control valve adjusting screw, bleed air through threads, and reset system pressure.

Pump Slow Going Out of Stroke

Wear at pump shaft seal groove causes crankcase oil leakage.
Replace pump housing and seal.

BRAKE MALFUNCTIONS

Excessive Pedal Leak-Down

Brakes not adjusted
Bleed and adjust brakes.

Leaking brake valve piston O-ring. (Look for external leakage on brake valve.)
Replace O-rings.

Leakage past pressure ring packings in axle housing or leaking brake oil line.
Replace pressure ring packings.
Tighten brake oil line connections.

Defective equalizing and reservoir check valves.
Locate difficulty in either a defective reservoir check valve or equalizing valve as follows:
1. Isolate brake valve from wheel cylinders in axle housing and check for pedal leak-down. If leak-down stops, difficulty is in individual brake assembly in axle housing.
2. If after brake valve isolation, difficulty continues, depress brake pedals separately, then simultaneously. If leak-down occurs in both cases, a defective reservoir check valve is indicated. If leak-down occurs on individual pedal operation and not during simultaneous operation, a defective equalizing valve is indicated.

Excessive Brake Chatter

Incorrect or contaminated oil in hydraulic system.
Drain and fill system with proper oil.

Air in system.
Bleed and adjust brakes.

STEERING MALFUNCTIONS

Sluggish Steering

Failed piston O-rings.

Failed O-rings in valve housings.

Leakage past steering valve body.
Replace valve body assemblies.

Clogged transmission-hydraulic oil filter.

Leakage past valve seats.
Factory adjusted shim pack disturbed.

Loss of Steering

Insufficient oil supply to steering valve.
Transmission oil pump not functioning properly or not in operation (clutch disengaged).

Other hydraulic functions receiving priority.
Adjust pressure control valve.

Clogged transmission-hydraulic oil filter.
Replace filter.

Main hydraulic pump not functioning.
Open pump shut-off screw.
Repair main hydraulic pump.

Steering Slow in One Direction

Leakage past steering valve body.
Valve seat worn or distorted.
Dirt on valve seat.
Replace valve body assemblies.

Hydraulic Components Chattering

Failed O-rings in steering valve housing.

ROCKSHAFT MALFUNCTIONS

Rockshaft Rises Slowly or Fails to Rise

No pump pressure.
Check operation of main hydraulic pump.

Discharge valve stuck in open position.
Check by closing throttle valve. If rockshaft rises, check for dirt in discharge valve; also check for defective O-rings and back-up ring in valve plug.

Rockshaft control valve linkage spring unhooked or weak.
Check by observing valve link through plug on side of rockshaft housing. If link moves when tractor is shut off, the linkage spring is defective or unhooked.

Piston O-ring failed.

Clutch pedal depressed.
Release clutch pedal, allowing transmission oil pump to operate.

Low pump flow.
Check and adjust main hydraulic pump.

Negative stop screw not adjusted properly.

Cam follower adjusting screw not adjusted properly, causing improper raise in Load (L) control.
Adjust cam follower adjusting screw.

Flow control valve adjusted improperly.

Transmission-hydraulic oil filter dirty.

Rockshaft Valves Hunting or Erratic

Valves too tight (both valves held open).
Adjust valve neutral range.

Rockshaft piston O-ring failed.

Defective thermal relief valve.

Leaking discharge valve.
Check valve for dirt or defective valve plug, O-rings and back-up ring.

Rockshaft Fails to Lower or Lowers Too Slowly

Throttle valve closed.

Valve linkage failed or disconnected.

Rockshaft Rises Too Fast

Incorrect setting of flow control valve.
Remove shims to decrease flow.

Rockshaft Fails to Rise Under Load

Excessive load.

Insufficient pump pressure.
Check and adjust main hydraulic pump.

Negative stop screw incorrectly adjusted.

Piston O-ring failed.

Rockshaft cylinder and valve housing to rockshaft housing or transmission case packings failed.

Thermal relief valve defective.

Incomplete Rockshaft Rotation in Depth Control

Rockshaft control lever positioned incorrectly.

Insufficient Load Response

Selector lever in depth (D) or load and depth (LD) position.

Move selector lever to load control (L) setting.

Excessive valve clearance.
Adjust valves.

Valves sticking.
Check for weak valve springs or dirt in valves.

Control lever too far down on quadrant for load.
Position lever for desired load.

Load control shaft or bushings worn.

Negative stop screw turned in too far.

Excessive Load Response

Selector lever in load control (L) setting.

Move selector lever to load and depth (LD) position.

Bypassing of Oil, Causing Heating of Transmission-Hydraulic Oil

Valves adjusted too tight (both valves open).
Adjust valve clearance.

Valves leaking.
Check valves for dirt and replace valve plug, O-ring, and back-up rings.

Thermal relief valve failed.

O-rings failed in control valves.

Rockshaft Settles Under Load

Discharge valve leaking.
Check this by bottoming throttle valve; settling should cease. Check valve for dirt, or leaking valve plug.

Rockshaft cylinder check valve ball leaking.
Replace ball or reface ball seat.

Leaking pipe plug in rockshaft cylinder.

Porous or failed rockshaft cylinder valve housing.

SELECTIVE CONTROL VALVE MALFUNCTIONS

Cylinder Will Not Extend

Check oil supply to valve.

Pressure valve not opening.
Adjust operating cams.

Return valve not opening (in case of double acting cylinder).

Return valve leaking.
Clean valve, resurface seat, and adjust operating cams.

Rocker to control shaft roll pin sheared.
Install new roll pin.

Porous selective control valve housing.
Replace housing.

Metering valve plugged.
Clean valve.

Check for obstruction in valve to cylinder line.

Cylinder Will Not Retract

Rocker to control shaft roll pin sheared.
Install new pin.

Pressure valve leaking.
Clean valve, resurface seat, and adjust operating cams.

Return valve closed.
Adjust operating cams.

Cylinder Settles in Neutral or Under Load

Return valve leaking.
Clean valve, resurface seat, and adjust operating cams.

Porous selective control valve housing.
Replace housing.

Control Lever Does Not Return to Neutral

Detent piston sticking.
Remove foreign material.

Operating lever in float position.
Lever must be manually returned to neutral.

Control lever linkage bent or binding.
Replace parts.

Pressure valve springs weak.
Test to specifications.

Return valves not seating.
Clean valves, resurface seat, and adjust operating cams.

Cylinder has extensive internal leaks.

Control Valve Will Not Stay in Detent

Detent rocker worn or broken.
Replace failed parts.

Flow rate set too high.

Detent piston sticking.
Remove foreign material.

Cylinder Operates Fast or Slow

Metering valve incorrectly adjusted or sticking.
Remove foreign material and adjust metering valve.

Flow control valve sticking.
Remove foreign material.

Flow control valve spring worn or broken.
Replace spring.

Pressure or return valve sticking or leaking.
Clean valves, resurface seat, and adjust operating cams.

TESTING AND ADJUSTMENT

Transmission Oil Pump Flow Test

Start the engine and operate functions to heat the oil to 100°F (38°C).

Stop the engine and check transmission oil level.

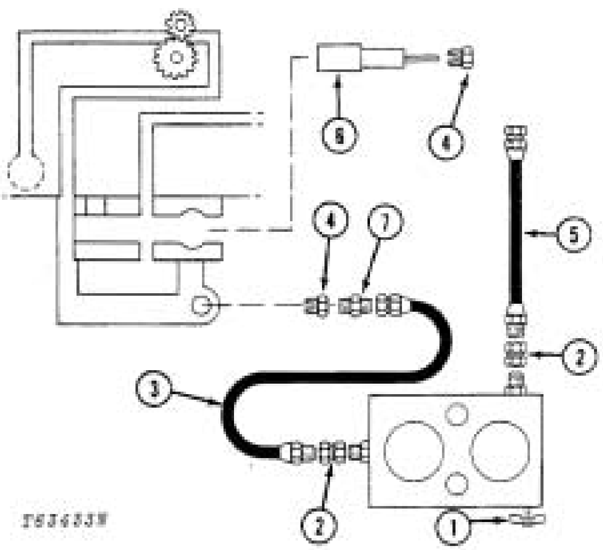
Remove the transmission filter cover and filter.

Install the dummy filter and flowmeter as shown in Figure 3 or 4.

NOTE: If dummy filter assembly leaks, grind a step back on the filter housing cover assembly JD-293-1 as shown in Figure 5.

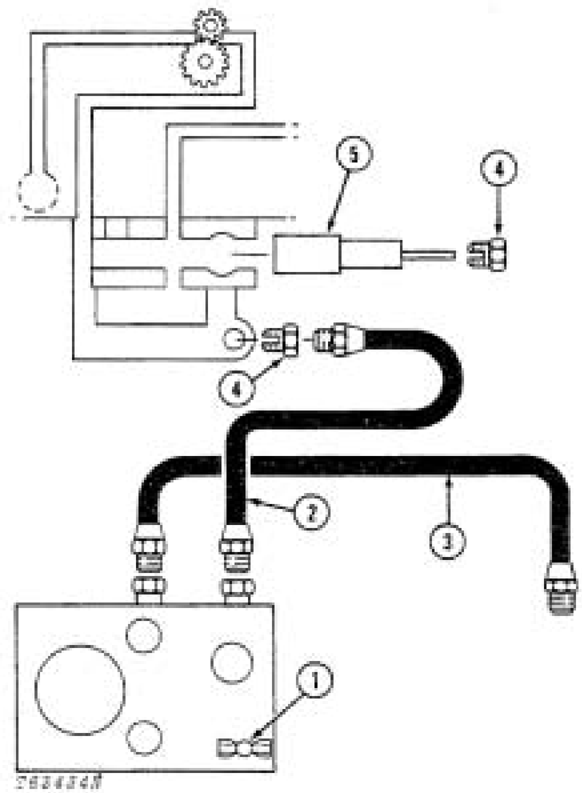
The tester inlet hose attaches to the filter housing cover using a D-89 fitting.

The tester outlet hose should be inserted into the transmission filler neck.



1—Pressure Loading Valve Handle
2—D-96
3—D-91 Tester Inlet Hose
4—D-89
5—D-91 Tester Outlet Hose (to trans. filler neck)
6—Dummy Filter Relief Valve Spool
7—D-88

Fig. 3-Transmission Oil Pump Test Using Nuday Hydraulic Tester



1—Pressure Loading Valve Handle
2—Tester Inlet Hose
3—Tester Outlet Hose (to trans. filler neck)
4—D-89 Fitting
5—Dummy Filter Relief Valve Spool

Fig. 4-Transmission Oil Pump Test Using OTC Hydraulic Tester

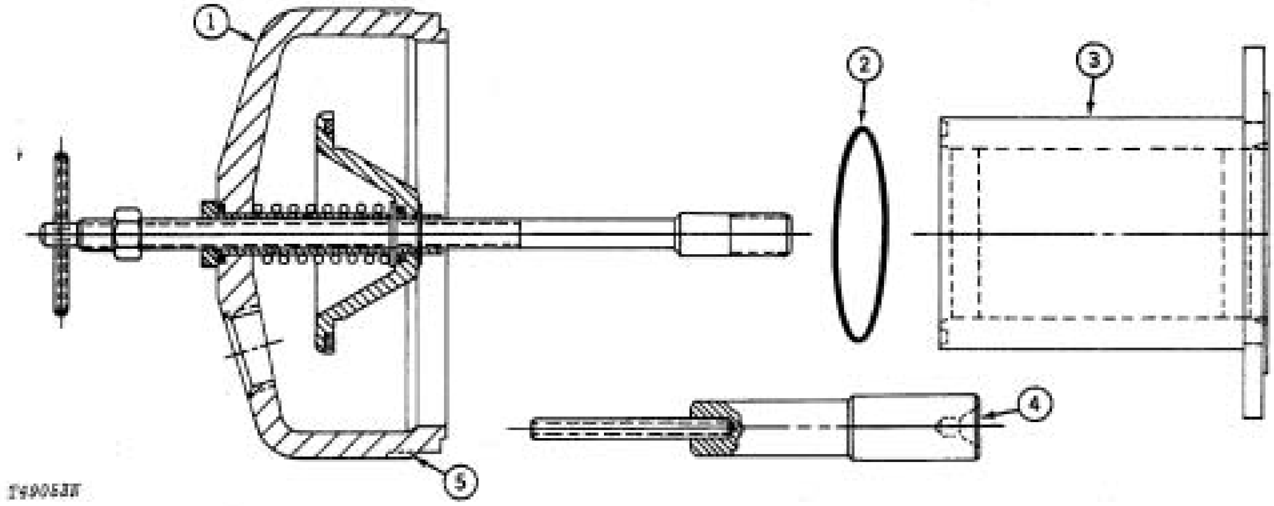
Remove transmission oil filter relief valve plug.

Remove oil filter relief valve cartridge.

Install dummy filter relief valve spool (JD-293-4).

Secure the spool assembly JD-293-4 into the relief valve port with the D-89 fitting. Do not cap the fitting.

NOTE: If oil leaks from the D-89 fitting during test, stop and check the dummy filter for proper installation of components or leaking O-rings.



1—Filter Housing Cover Assembly (JD-293-1)
2—O-Ring
3—Filter Assembly (JD-293-2)
4—Spool Assembly (JD-293-4)
5—Distance to Grind Step Back

Fig. 5-Parts for Installing Dummy Filter

With the flow meter pressure control valve open, start the engine and adjust the engine speed to maintain 2500 rpm.

Slowly close the pressure control valve to maintain the test pressure of 150 psi (10.3 bar). Recheck rpm and record the pump flow.

The minimum acceptable pump flow is 7.0 gpm (0.44 L/s).

Test Diagnosis

If pump flow is to specifications, but pressure is low, check the pressure regulating valve for malfunction.

If the pressure is to specifications but the pump flow is low, check for (1) plugged transmission pump inlet screen (2) faulty transmission filter relief valve (3) worn transmission pump.

To check the filter relief valve install dummy filter but not the relief valve spool. Establish pump flow and pressure. Raise the pressure with the tester loading valve until flow drops off. The filter relief valve should open at 50 psi (3 bar) (4 kg/cm²).

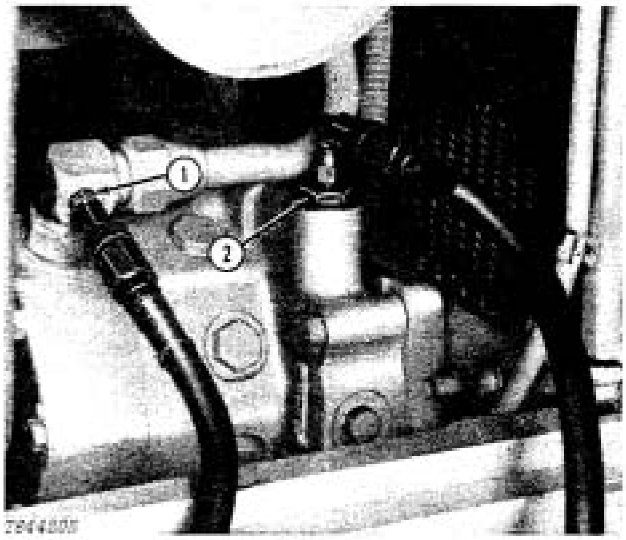
Main Hydraulic Pump Flow Test

1. Discharge the hydraulic system pressure by operating the steering and optional equipment.

2. Tee a 0 to 300 psi (0 to 21 bar) gauge into the pump inlet (1, Fig. 6) to monitor charge pressure.

   On early units it will be necessary to install a tee connector.

3. Install a 0 to 3000 psi (0 to 210 bar) gauge into the stroke control valve upper plug (2, Fig. 6) to monitor standby pressure.



1—Charge Pressure Test Port **2—Standby Pressure Test Port**

Fig. 6-Main Hydraulic Pump Test Port Locations

4. Connect the inlet of the hydraulic tester to the pump outlet fitting (Fig. 7).

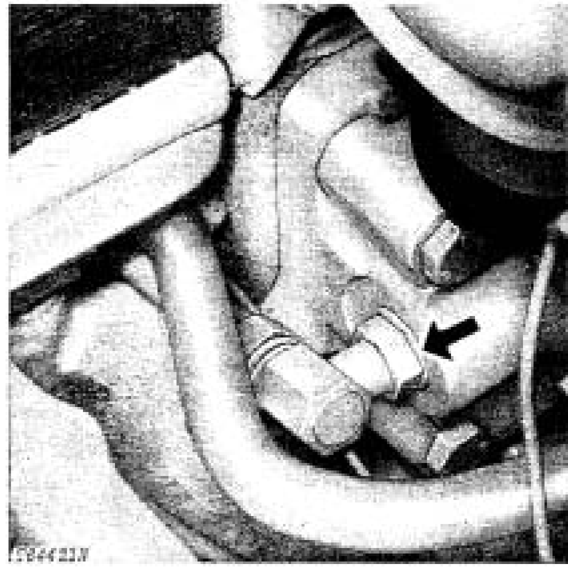
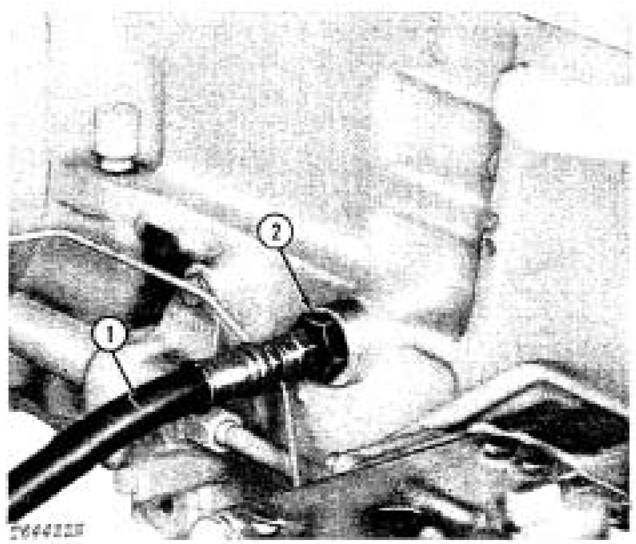


Fig. 7-Pump Output Port

5. Remove the transmission filter relief valve bore plug and install the D-93 slotted fitting (2, Fig. 8) to hold valve in place.

6. Connect the hydraulic tester return (1, Fig. 8) to the D-93 slotted fitting.



1—Hydraulic Tester Return Hose **2—D-93 Fitting**

Fig. 8-Connecting Flow Meter Outlet Hose

7. Start and run the unit at 1875 rpm. Adjust flow meter pressure control valve to obtain approximately 2000 psi (138 bar) at the flow meter pressure gauge. Continue to run the engine until oil temperature reaches 126.5°F (50°C).

8. Completely close the flow meter pressure control handle. Run the engine at 2500 ± 5 rpm and check system standby pressure on the gauge. If necessary, adjust stroke control valve to obtain standby pressure of 2250 ± 50 psi (155 ± 3 bar).

9. Run engine at 2000 ± 5 rpm and fully open the flow meter pressure control handle. Record the flow.

   The minimum acceptable flow is 11.4 gpm (0.71 L/s). Low flow may indicate a charge circuit problem, defective flow meter, incorrect engine speed, or a defective pump.

10. Slowly close the pressure control valve until 2000 psi (138 bar) is registered on the pressure gauge at the pump and record pump flow. Maintain an engine speed of 2000 ± 5 rpm.

    The minimum acceptable flow is 8.8 gpm (0.55 L/s).

11. With the pressure still at 2000 psi (138 bar) check the charge pressure. Charge pressure must be 80 ± 50 psi (6 ± 3 bar). If charge pressure is 30 psi (2 bar) or less, main pump flow test results will be invalid. If charge pressure is above 130 psi (9 bar) the oil cooler relief valve is not functioning properly. Correct the charge circuit problem and retest.

12. Determine the pump efficiency by dividing the flow recorded in Step 10 by the flow recorded in Step 9. If the pump percentage drops below 75%, the pump should be repaired.

    If the pump percentage is above 75% and the flow is less than the minimum flow value, flow meter error is likely.

REVERSER CLUTCH CONTROL VALVE

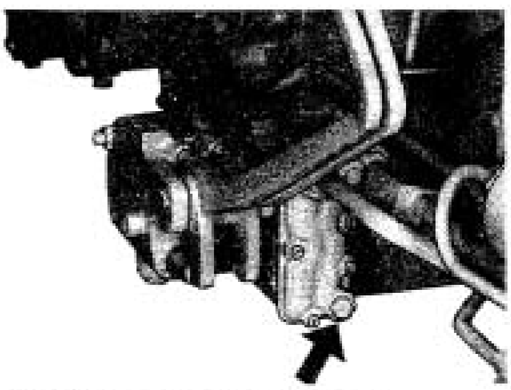
System Pressure Tests

Pressure Regulating Valve Adjustment

First check the reverser system pressure and adjust if necessary. Remove the plug at the bottom of the control valve housing cover and install a pressure gauge.

Place the left-hand transmission shift lever in "park," start the tractor engine and set speed at fast idle.

With the clutch pedal in the engaged position, observe reading on gauge. Reverser system pressure should be 145 to 155 psi [10.19 to 10.90 kg/cm²] at 180°F [82.2°C].



T28261

Fig. 9-Pressure Regulating Valve Plug

If pressure is not within the correct range, remove plug in reverser control valve cover (Fig. 9) and add or deduct shims until correct pressure is reached.

Clutch Control Valve Test

Perform this check only after the reverser system pressure check is completed to be sure system pressure is within full engagement pressure specifications.

NOTE: Before checking or adjusting clutch control valve, be sure the dry-type disconnect clutch wear adjustment is correct. See Section 40, Group 5.

Remove the clutch pressure tap plug at the bottom of the control valve housing cover. Install a pressure gauge.

Place the transmission shift lever in "park" position and start the tractor engine. Set the engine at fast idle and place the reverser control lever in either forward or reverse. Record pressure reading and check remaining shift position. Pressure reading should read the same in either position.

Pressure reading should be full engagement pressure. If reading does not fall within this range, adjust valve as follows:

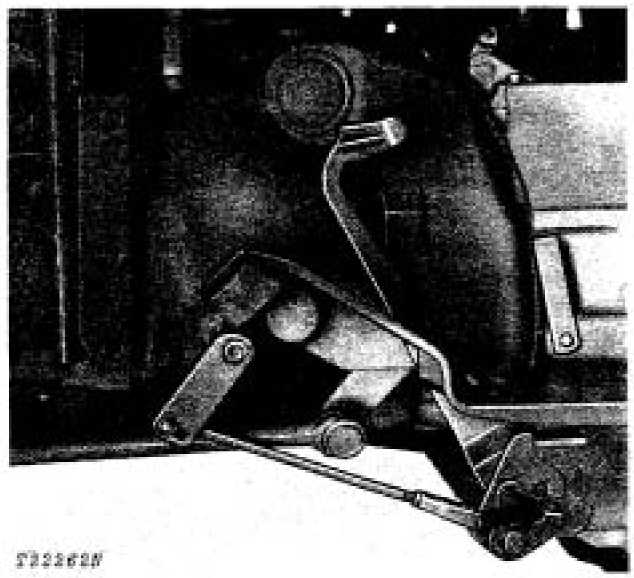


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Fig. 10-Clutch Pedal Shaft Arm Adjusting Screw

Loosen clutch pedal-to-clutch pedal shaft arm screw and adjust the clutch pedal shaft arm adjusting screw until a reading of 130 psi [9.14 kg/cm²] is shown on the gauge. Turn the screw in 1-1/2 turns and tighten jam nut. Tighten clutch pedal-to-clutch pedal shaft screw with pedal in upper position. Pressure reading will now be correct full engagement pressure.

If pressure is not within the specified range, repeat check on clutch pack not tested. If results are within correct range, check for excessive leakage in the oil circuit of the other clutch pack oil circuit. Check both clutch oil circuits if oil pressure is still below the desired specification.

Shift Adjustment

The reverser may be adjusted for a firm rapid shift or for a slower shift. It is desirable to have the speed-of-shift as rapid as possible without a jerky shifting motion.

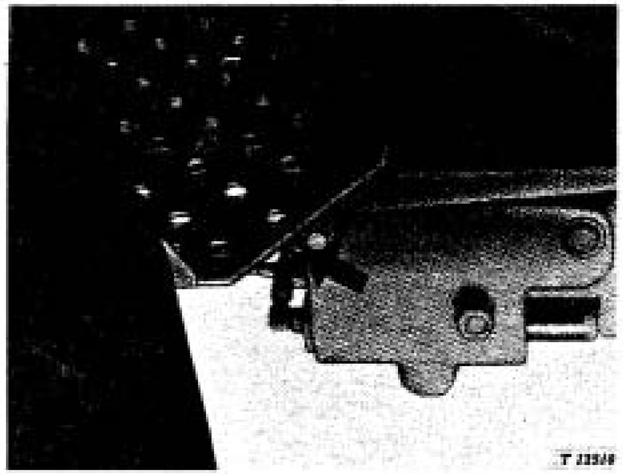


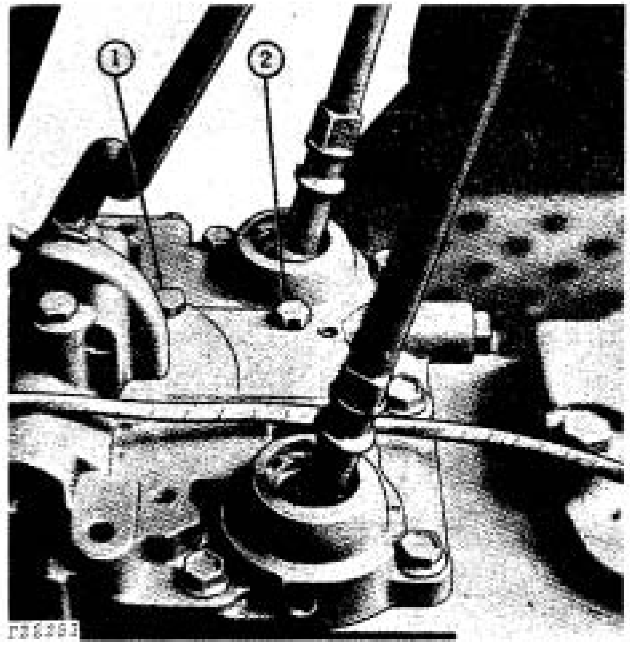
Fig. 11-Speed-Of-Shift Adjusting Screw

To adjust reverser shifting, stop the engine and locate the speed-of-shift adjusting screw (accumulator charging orifice screw) located on the rear side of the control valve cover (Fig. 11).

Turn IN the adjusting screw with a screwdriver to slow down the shift. To speed up the shift for heavy loads or when the shift becomes too slow, back OUT the adjusting screw. Turn the adjusting screw one-fourth turn at a time until the desired speed of shift is obtained.

See "Specifications" for recommended shift time when making this adjustment.

INDEPENDENT PTO CONTROL VALVE



1—Brake Test Port **2—Clutch Test Port**

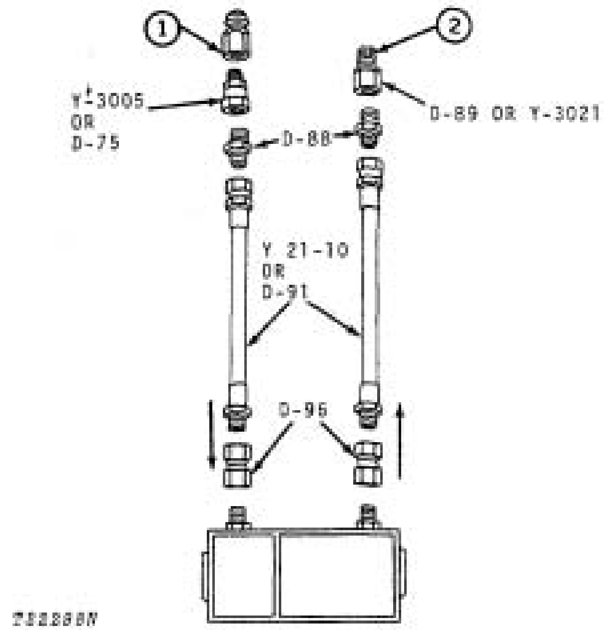
Fig. 12-PTO Test Ports

Install a pressure gauge in both PTO test ports; start engine and fully engage and disengage the PTO lever and record the oil pressure of 140 to 160 psi [9.84 to 11.25 kg/cm^2] at 130° to 160°F. [54.4° to 71.1°C].

As the PTO control lever is slowly moved from the engaged position to the disengaged position, one pressure gauge should register zero pressure before the other gauge begins to record pressure. No pressure overlap should be experienced when shifting the PTO slowly between operating positions.

If pressure is lower than specified or if the PTO stub shaft turns when the lever is disengaged, do not put the PTO under load until these conditions are corrected.

SELECTIVE CONTROL VALVE



1—AR30210 Coupler

2—Install at Oil Filter Relief Valve Plug

Fig. 13-Selective Control Valve Check

Connect hydraulic tester as shown in Fig. 13. Open hydraulic tester pressure loading valve. Start engine and adjust to 2500 rpm. Move selective control valve lever forward and hold it there.

Close the pressure loading valve on the test unit until a reading of 1500 psi (105.46 kg/cm²) registers on the pressure gauge. Oil flow through the selective control valve should be from 2 gpm (7.6 L) to full pump flow depending on the position of the selective control valve metering valve. When metering valve is in the center position flow should be 6 to 7 gpm (22.7 to 26.5 L).

If necessary, adjust selective control valve metering valve (Section 50, Group 50).

PRESSURE CONTROL VALVE (-246127)

Testing Without Pressure Gauge

NOTE: This check should only be used when it is not practical or possible to use a pressure gauge. DO NOT attempt to adjust the pressure control valve setting using this check.

Run the engine at slow idle.

Turn the steering wheel back and forth, noting effort required and the system response.

Now operate a non-priority function (loader) and at the same time turn the steering wheel back and forth. There should be no change in steering effort or response. Any loss of steering indicates a problem with the pressure control valve.

Testing with a 3000 Psi [210.9 kg/cm²] Pressure Gauge

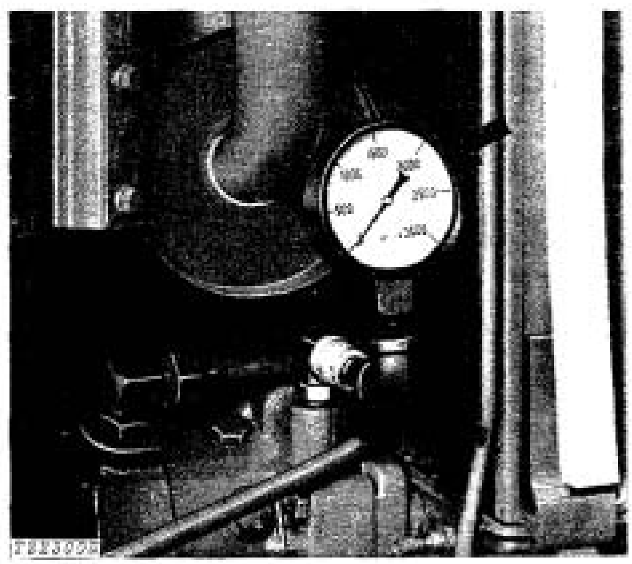


Fig. 14-Pressure Gauge in Hydraulic Pump

Install a 3000 psi [210.9 kg/cm²] pressure gauge as shown in Fig. 14.

Run the unit and adjust the hydraulic pump stroke control valve for a 1500 psi [105.46 kg/cm²] reading on the pressure gauge.

Operate a non-priority function (loader). The function should not operate.

If the non-priority function does operate, there is a malfunction in the pressure control valve (probably dirt in the valve or a broken spring). Correct this problem before proceeding with the next step.

Adjust stroke control valve to raise the hydraulic pump pressure in 50 psi [3.51 kg/cm²] increments. After each adjustment, move the control lever to operate the non-priority function. Note the pressure gauge reading when the function begins to operate. Pressure should be 1700 to 1800 psi [119.5 to 126.5 kg/cm²] pressure control valve setting. If necessary, adjust pressure control valve.

Readjust the stroke control valve to obtain hydraulic system stand-by pressure of 2300 to 2400 psi [161.7 to 168.7 kg/cm²].

NOTE: The following is an alternate procedure which can be used to test the pressure control valve setting.

Install a 3000 psi [210.9 kg/cm²] capacity pressure gauge in pump pressure tap.

Run the unit and observe pressure gauge reading. The gauge reading should be 2200 to 2300 psi [154.7 to 161.7 kg/cm²]. If necessary, adjust stroke control valve to obtain correct pressure.

Check a non-priority function for normal operation.

Operate non-priority function and observe pressure reading on gauge as function operates. Reading should be 1700 to 1800 psi [119.5 to 126.5 kg/cm²] pressure control valve setting. If necessary, adjust pressure control valve.

PRESSURE CONTROL VALVE (246128-)

Testing with a 0 to 3000 psi (0 to 211 kg/cm²) pressure gauge

Install a 0 to 3000 psi (0 to 211 kg/cm²) pressure gauge in the main hydraulic pump pressure tap (Fig. 14).

With engine set at 1000 rpm, operate loader valve or other non-priority function.

Pressure gauge will indicate the pressure control valve setting.

Pressure gauge should read 1600 ± 50 psi (112 ± 4 kg/cm²).

Adjust pressure control valve setting, if necessary. Adding shims increases valve setting and removing shims decreases valve setting.

TESTING STEERING SYSTEM

On any power steering problem, always check the main hydraulic pump and pressure control valve to be sure they are operating properly.

With engine stopped, check manual steering. Have front wheels raised off the ground. Turn steering wheel back and forth to both steering limits. There should be no binding or extreme hard turning spots. If binding or hard turning exist, check the mechanical linkage.

Start the engine and steer in both directions to the travel limits. Steering effort and response should be the same in both directions. Do this on both easy and hard steering surfaces. Slow steering or loss of steering in one direction indicates a problem with one or more of the components that control and contain pressure oil for that steering direction. Steering loss in both directions points to components common to both steering direction circuits.

Check for steering drift when the tractor is standing still, when it is moving, and with the front wheels raised. Drift is generally caused by steering valve or O-ring leakage in that steering direction circuit.

Steering valve leakage can be caused by a worn or distorted seat, dirt on the valve seat, or improper adjustment of the valve body shim pack.

The valve body shim pack adjustment is performed at the factory and adjustment should not be attempted. Be extremely careful when valve body assemblies are removed not to change the shim pack adjustment.

A large volume of oil leakage past the seal in the adjuster nut indicates a restricted or blocked return oil passage. This can be caused by improper installation of the lower needle thrust bearing on the steering wheel shaft. If the large chamfer of the thrust washer does not face the valve body, return oil flow will be restricted.

The return oil passage in the clutch housing can be blocked by using an improper gasket between the steering housing and clutch housing. The gasket used on manual steering will block this passage.

ROCKSHAFT

Rockshaft Thermal Relief Valve Check

Install a hydraulic hand pump equipped with a 5000 psi [351.5 kg/cm^2] pressure gauge in the single remote cylinder outlet (left side).

Raise pressure to thermal relief valve slowly. Valve should remain closed at 2500 psi [175.8 kg/cm^2]. When pressure reaches 3500 to 4500 psi [246.1 to 316.4 kg/cm^2], valve should open.

When checking the thermal relief valve in this manner, any seal or valve leakage will affect the test. **Do not exceed 5000 psi [351.5 kg/cm^2] pressure when checking the valve on the tractor as damage to seals might result.**

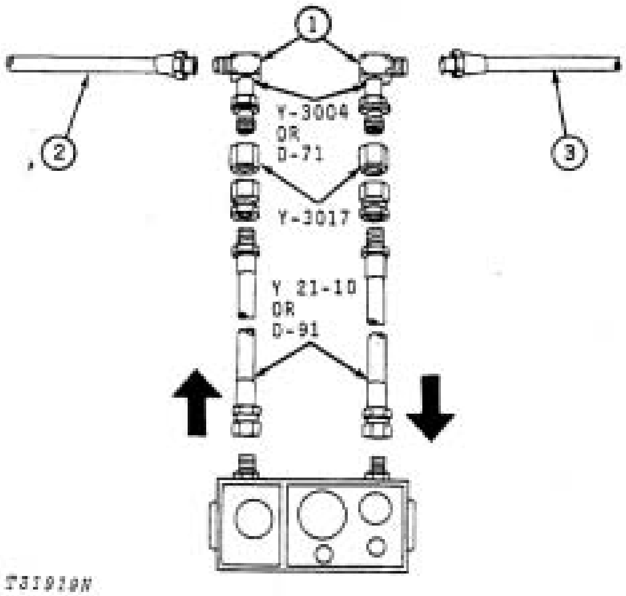
Rockshaft Flow Control Valve Check

Connect a hydraulic tester (in-line type only) as shown in Fig. 15. Open tester pressure loading valve. Start engine and adjust speed to 2500 rpm.

Place rockshaft selector lever in "L" position and record flow as rockshaft rises. If flow is not 4-3/4 to 5-3/4 gpm (18.00 to 21.75 L/min), adjust flow control valve.

An alternate and more accurate method to check flow is to connect tester "IN" line to rockshaft single remote cylinder outlet and "OUT" line as shown in Fig. 13. Open hydraulic tester pressure loading valve. Start engine and adjust speed to 2500 rpm.

Place rockshaft selector lever in "L" position and close pressure loading valve on the test unit until a reading of 1000 psi [70.3 kg/cm^2] registers on the pressure gauge. If flow is not 4-3/4 to 5-3/4 gpm (18.00 to 21.79 L/min) adjust flow control valve.



1—Remove R34063 Connector Install (2) AR27699 Elbows
2—To Pressure Control Valve
3—From Main Hydraulic Pump

Fig. 15-Test Hookup

CYCLE TIMES

Rockshaft

Set the engine speed at 2100 rpm. With the rockshaft in the fully lowered position, move the rockshaft control lever to the rear raising the rockshaft. The time required to fully raise the rockshaft is 1.9 to 2.3 seconds.

Remote Cylinder

With engine set at 2100 rpm, operate selective control lever to extend the remote cylinder. Time required to extend cylinder is 2.0 seconds.

Loader

With the engine at full throttle, check loader cycle times and compare with times listed below.

Boom raise..4.50 sec.
Boom lower (power)....................................2.60 sec.
Bucket dump (stop to stop)........................3.20 sec.

BRAKE SYSTEM ADJUSTMENT AND BLEEDING

The following adjustment and bleeding procedures are to be made in the sequence shown any time the brake valve is removed and disassembled.

1. Bleeding Air from the Brake System

Run the tractor engine for approximately two minutes to allow the transmission lubricating system to fill brake valve reservoir (clutch engaged and engine at fast idle).

NOTE: If it is not desirable to run tractor engine at this time, the brake valve reservoir may be filled by removing the filler plug on top of the valve.

With tractor engine running, attach a clear plastic bleeder tube to a brake bleed screw (located on top of axle shaft housing) and insert the tube in the transmission filler hole on rear of rockshaft housing.

Unscrew bleed screw 3/4 turn, slowly depress brake pedal on brake being bled, and allow it to return slowly. Continue operating pedal until oil in tube is free of air bubbles.

Never allow brake pedal to return sharply, permitting brake valve piston to release quickly, as damage to valve parts may occur before brakes are completely adjusted.

NOTE: If it is not desirable to run tractor engine when bleeding the brakes, insert end of bleed tube in the top of the brake valve and bleed brakes as instructed above.

With brake pedal depressed, close bleed screw securely. Remove bleeder tube and repeat bleeding operation on other brake.

2. Brake Pedal and Equalizing Valve Adjustment

This adjustment must be made any time the brake valve is disassembled. Failure to adjust pedal stop screws will allow a mechanical interference between the brake pistons and reservoir check valves, causing undue wear on valve parts.

Make this adjustment after the system is free of air.

Right-Hand Pedal Adjustment

Adjust the right-hand brake pedal adjusting screw so that the right-hand brake piston is fully extended from the housing and the brake pedal arm is tight against the piston (not so tight as to move piston) with no piston free travel.

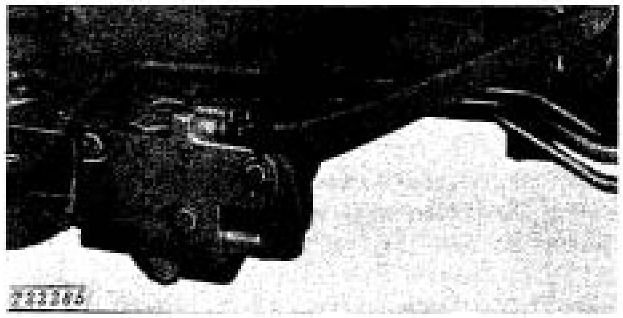


Fig. 14-Brake Pedal Adjustment

Apply a minimum of 10 pounds [4.5 kg] to the left-hand brake pedal. If the left-hand pedal starts to settle, turn the right-hand pedal adjusting screw out (counterclockwise) until settling stops. Turn adjusting screw an additional 1/3 turn after settling stops.

Left-Hand Pedal Adjustment

Adjust the left-hand brake pedal adjusting screw so that the left-hand brake piston is fully extended from the housing and the brake pedal is tight against the piston (not so tight as to move piston) with no piston free travel.

Apply a minimum of 10 pounds [4.5 kg] to the right-hand brake pedal. If the right-hand pedal starts to settle, turn the left-hand pedal adjusting screw out (counterclockwise) until settling stops. Turn adjusting screw an additional 1/3 turn after settling stops.

After both pedals have been adjusted, align the pedals by turning the screw on the highest pedal counterclockwise - 1/6 turn maximum.

Check Brake Pedal Settling

Apply a 60 pound [27.2 kg] continuous force to each brake pedal and hold for one minute. Pedal should not settle more than one inch during this period.

IMPORTANT: Check each pedal separately, not both simultaneously.

HYDRAULIC SYSTEM ANALYZER

Group 26
HYDRAULIC SYSTEM (ANALYZER)

GENERAL INFORMATION

1—Master Hydraulic System Analyzer
2—Tachometer/ Temperature Reader

Fig. 1-Hydraulic System Analyzer

The components of the Hydraulic Analyzer are a master hydraulic system analyzer, a tachometer/temperature reader and an accessory kit for utility equipment.

The master hydraulic system analyzer is used for the measurement of pressures in the hydraulic system. Two vacuum gauges are also available when needed. Each gauge is connected to a coupling adapter. The coupling adapters and gauges have numbers for identification.

The contents of the analyzer are:

1. One 0 to 5000 psi (0 to 345 bar) pressure gauge.
2. One 0 to 30 in. Hg (0 to 1 016 mbar) vacuum or a 0 to 150 psi (0 to 10 bar) pressure gauge.
3. One 0 to 30 in. Hg (0 to 1 016 mbar) vacuum gauge.
4. Four 0 to 400 psi (0 to 28 bar) pressure gauges.

The tachometer/temperature reader is used for the measurement of engine rpm and the oil temperature of hydraulic system. The power for the reader is the loader electric system. The reader is adaptable to either 12 or 24 volt system.

For easy connection of the analyzer the accessory kit has the necessary fittings, adapters and orifices.

The design of the Hydraulic Analyzer is for the test of hydraulic systems. The test of hydraulic system conditions are made at specific engine rpm, oil temperature and with the specific orifice installed. The orifice is installed into a circuit so all flow from the hydraulic pump goes through it.

To check for leakage in a circuit use the following general procedure. Install the orifice into the circuit. Connect the pressure gauges to the test ports of the hydraulic pump. Connect the tachometer/temperature reader to the unit. Start the engine and run at 1500 rpm. Operate the control lever (the circuit with orifice installed) to put the cylinder at the end of its stroke. Hold the control lever in this position. This will cause the hydraulic oil to flow through the orifice and heat the oil. When the oil is at the specific temperature, increase or decrease engine rpm to get the specific pressure. If the engine rpm is more than the specification the circuit has leakage or the hydraulic pump is worn.

The Hydraulic System Pretest Check Sheet (Fig. 2) is a general list of possible symptoms (problems) of the hydraulic system.

The Symptom Index is a list of possible symptoms from the Pretest Check Sheet and customer complaint. Also next to the symptom is the probable faulty component(s) and a test to verify it.

Follow the procedure below to test the hydraulic system:

1. Do the Pretest Inspection and Operational Checks. Write the results on the Pretest Check Sheet.

2. Find the symptoms from the Pretest Check Sheet in the Symptom Index, page 70-76-5 to 70-26-7.

3. Do the verification tests.

CAUTION: Escaping fluid under pressure can have sufficient force to penetrate the skin, causing serious personal injury. Before disconnecting lines, be sure to relieve all pressure. Before applying pressure to system, be sure all connections are tight and that lines, pipes and hoses are not damaged. Fluid escaping from a very small hole can be almost invisible. Use a piece of cardboard or wood, rather than hands to search for suspected leaks.

If injured by escaping fluid, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered immediately.

PRETEST INSPECTION

1. Write the machine identification information on Hydraulic Systems Pretest Check Sheet (Fig. 2). (Form M-5107-Stock-5-76)
2. Write the customer description of problem on Check Sheet.
3. Clean machine as needed for visual inspection.
4. Inspect these items: (Write the results on Check Sheet)

   Hydraulic oil
   Transmission filter
   Function return filter
   Transmission oil cooling system
   Hydraulic lines and fittings
   Cylinders

5. Correct problems noted.
6. Do the Operational Checks.

OPERATIONAL CHECKS

1. Write the following information on the Hydraulic System Test Record.

   Machine description
   Test specifications
   Circuit relief settings

2. Start engine.
3. Operate the functions until hydraulic oil is warm.
4. With engine at fast idle, operate functions. Write the cycle times on Hydraulic System Test Record. Observe operation of functions.
5. Compare recorded cycle times with specification cycle times.
6. Check applicable symptoms on Check Sheet.
7. Inspect hydraulic oil for bubbles.
8. Inspect filters for plugging and particles.
9. Go to Symptom Index, pages 70-26-5 to 70-26-7. Select probable faulty component(s). Select component test.

HYDRAULIC SYSTEM PRETEST CHECK SHEET

Machine Identification

Customer Comments: ____________________

PRETEST INSPECTION

1. Clean machine as required.
2. Perform all inspections.
3. Correct any problems.
4. Perform Operational Check.

Hydraulic Oil

	Yes	No
Correct type	☐	☐
Correct level	☐	☐
Bubbles in oil	☐	☐
Other ________	☐	☐

Oil Cooler

	Yes	No
Clear of dirt, debris	☐	☐
Fan or shroud damaged	☐	☐
Belt tension and condition	☐	☐
Leaking cooler or lines	☐	☐

Control Valve(s)

	Yes	No
Bent linkage	☐	☐
Properly adjusted linkage	☐	☐

Hydraulic System

	Yes	No
Bent or damaged lines	☐	☐
External oil leaks	☐	☐
Cylinder Rod(s) Bent	☐	☐
Frequently blown seals and fittings	☐	☐

Filters:

	Transmission Yes	Transmission No	Return Yes	Return No	Hydraulic Yes	Hydraulic No
Ruptured Filter	☐	☐	☐	☐	☐	☐
Plugged Filter	☐	☐	☐	☐	☐	☐
Metal Particles	☐	☐	☐	☐	☐	☐
Packing Particles	☐	☐	☐	☐	☐	☐
New Filter Installed	☐	☐				

OPERATIONAL CHECK

1. Start engine. Warm the hydraulic oil as described in the machine Technical Manual.
2. With engine at specified fast idle, cycle each circuit.
3. Record cycle times. Check applicable symptoms.
4. Reinspect hydraulic oil for bubbles.
5. Go to Symptom Index in machine Technical Manual to select and verify faulty component.

No hydraulics	☐	
No power in hydraulics	☐	
Slow hydraulics, general	☐	
Slow hydraulics in circuit	☐	________ (Name of circuit)
Slow circuit in one direction	☐	________ (Name of circuit)
Chattering hydraulics, general	☐	
Chattering hydraulics in circuit	☐	________ (Name of circuit)
Circuit initially moves in opposite direction	☐	________ (Name of circuit)
Wrong circuit operates	☐	________ (Name of circuit)
Drift or leakdown in circuit	☐	________ (Name of circuit)
Sticky operation of control valves	☐	
Noisy pump	☐	
Filter warning indicator on	☐	
Slipping transmission	☐	

COMMENTS: ____________________

M-5107-STOCK-5-76

Z48052N

Fig. 2-Hydraulic System Pretest Check Sheet

SYMPTOM INDEX

SYMPTOMS	PROBABLE FAULTY COMPONENT	VERIFICATION
Drift or leakdown in hydraulic circuit. Possible: No power in circuit	Cylinder(s) Loader control valve Selective control valve	Do the Cylinder Leakage Test, page 70-26-16. If the problem is not the cylinder(s) do the Circuit Leakage Test, page 70-26-15.
No power in a hydraulic circuit (loader or remote)	Loader control valve Selective control valve	Do the Circuit Leakage Test, page 70-26-15.
Circuit (loader functions) initially moves in opposite direction.	Lift check in the loader control valve	Inspect lift check valve and spring. Install new parts as necessary (Section 50, Group 45).
Slow or no loader operation No steering power during loader operation No hydraulic power in a non-priority circuit	Pressure control valve	Do Pressure Control Valve Test, page 70-26-20 or 70-26-21.
The hydraulic system is slow, general Chattering of the hydraulic system, general Transmission (reverser) is slipping Too much heat in hydraulic system, general	These problems have many possible causes	Do the System Test, page 70-26-8.
Chattering when a cylinder is being extended.	There is leakage from the charge or return circuit.	Do the System Test, page 70-26-8.

SYMPTOM INDEX

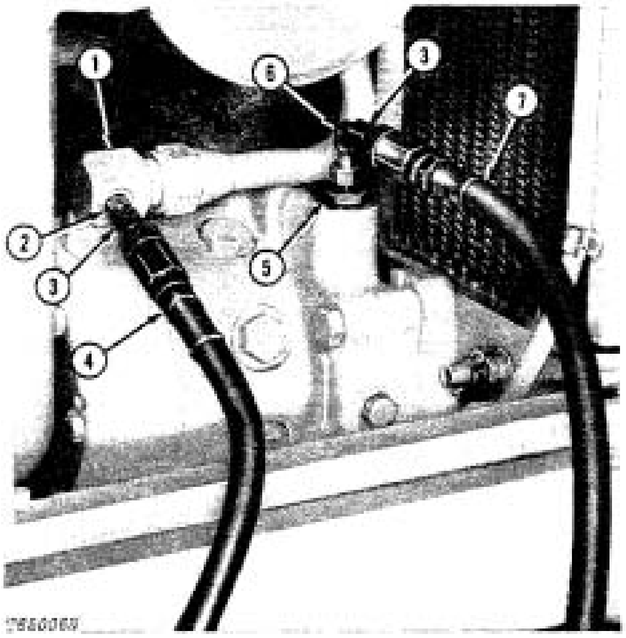
SYMPTOMS	PROBABLE FAULTY COMPONENT	VERIFICATION
Drift or leakdown of the rockshaft with a load	Discharge valve	Turn the throttle valve in. If drift is stopped, clean or install new parts as necessary (Section 50, Group 55)
	Rockshaft cylinder check ball	Inspect spring, steel ball and seat. Install new parts as necessary (Section 50, Group 55)
	Thermal relief valve	Install new part (Section 50, Group 55)
	Pipe plug in rockshaft cylinder	Put sealant on pipe plug and tighten (Section 50, Group 55)
	O-rings in valve or cylinder	Install new parts as necessary (Section 50, Group 55)
	Rockshaft cylinder and valve housing	Check for a crack in housing. Install new parts as necessary. (Section 50, Group 55).
Load on rockshaft initially moves in opposite direction	Rockshaft cylinder check ball	Inspect spring, steel ball and seat. Install new parts as necessary (Section 50, Group 55).
Rockshaft goes up slowly	Flow control valve	Check adjustment (Section 50, Group 55). Spring is weak or broken. Inspect and install new parts as necessary (Section 50, Group 55).
	O-ring on piston	Inspect and install new parts as necessary (Section 50, Group 55).
	Discharge valve	Valve is open all the time. Check for dirt in valve; also inspect valve plug for bad O-rings and back-up washer (Section 50, Group 55).

SYMPTOM INDEX

SYMPTOMS	PROBABLE FAULTY COMPONENT	VERIFICATION
Too many failures of O-rings, hoses and fittings. There is leakage to the outside of main pump.	High standby pressure	Do Standby Pressure Test, page 70-26-19.
	Filter screen in stroke control valve assembly.	Inspect screen for debris. Clean or install new part as necessary (Section 50, Group 10).
Main pump is slow to go in stroke when a control lever is moved.	Crankcase outlet valve.	Check the setting of crankcase outlet valve (Section 50, Group 10). If setting is correct, inspect valve for free movement in bore. Install new parts as necessary (Section 50, Group 10).

TEST AND ADJUSTMENT

System Test



1—202772 Elbow Adapter 90° (-290934)
2—202853 Straight Fitting (Pump Inlet Pressure)
3—202850 Coupling Adapter (2 needed)
4—36952 Hose Assembly 144 in. (3 658 mm)
5—202855 Straight Fitting (Pump Outlet Pressure)
6—202851 Swivel Elbow 90°
7—36953 Hose Assembly with Valve 144 in. (3 658 mm)

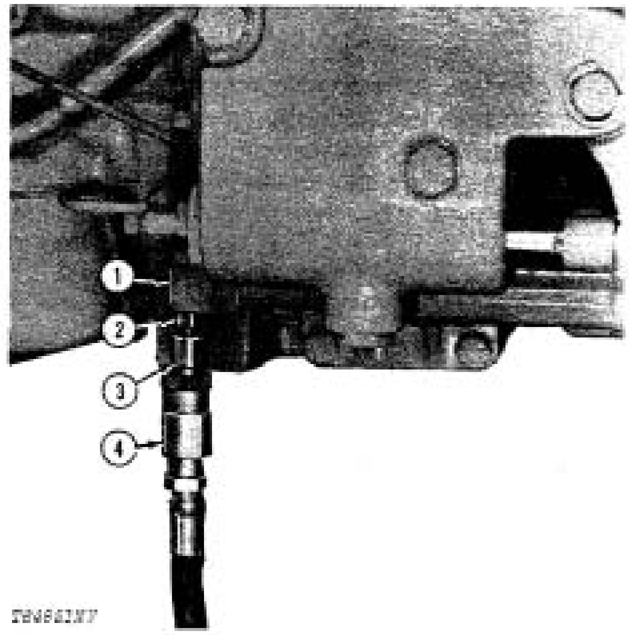
Fig. 3-Main Pump Test Connection

CAUTION: Stop the engine. Operate the steering valve and loader control valve to release hydraulic pressure in the system.

Slowly remove plugs from test ports of main pump to release the remainder of any hydraulic pressure in system.

Install fittings (2, 3, 5, and 6, Fig. 3) and hose assemblies (4 and 7) to test ports of main pump. Connect hose assembly (4) to No. 2 coupling adapter on Hydraulic Analyzer. Connect hose assembly (7) to No. 1 coupling adapter on Hydraulic Analyzer (Fig. 5).

NOTE: On units to (-290934) remove the adjustable elbow with no test port. Install elbow adapter (1, Fig. 3) with test port for pump inlet pressure.

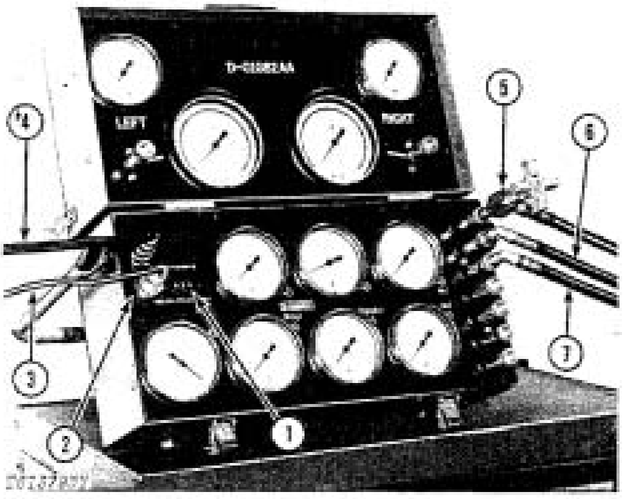


1—Reverse Clutch Control Valve
2—202853 Straight Fitting
3—202850 Coupling Adapter
4—36952 Hose Assembly 144 in. (3 658 mm)

Fig. 4-Reverser System Pressure (Transmission Pump Outlet)

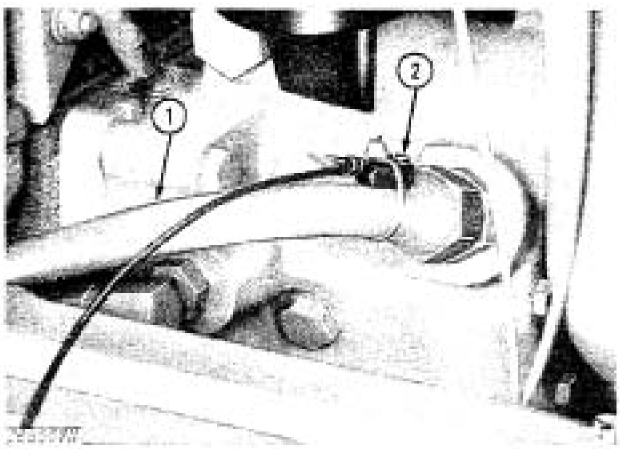
On units with a reverser install fittings (2 and 3, Fig. 4) and hose assembly (4) to control valve (1). Connect hose assembly to No. 3 coupling adapter on Hydraulic Analyzer.

NOTE: There is no connection for reverser system pressure (transmission pump outlet) on units not equipped with a reverser.



1—Thumb Dials (at 142)
2—Tachometer/Temperature Reader
3—Temperature Sensor Cable
4—Power/RPM Cable
5—Pump Outlet Pressure
6—Pump Inlet Pressure
7—Transmission Pump Outlet

Fig. 5-Hydraulic Analyzer

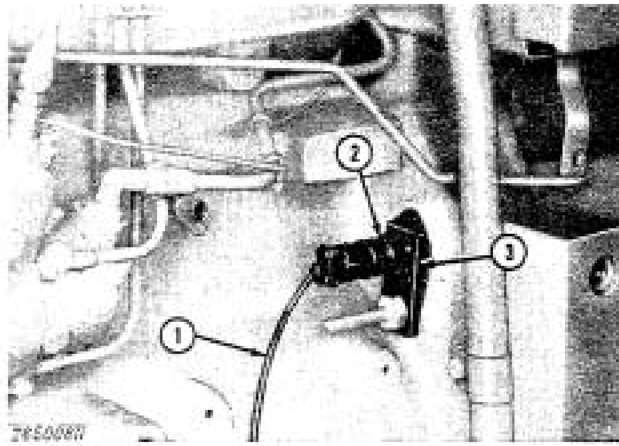


1—Pump Inlet Line
2—Temperature Sensor

Fig. 6-Install Temperature Sensor

Fasten temperature sensor (2, Fig. 6) to inlet line (1) with a plastic strap. Connect cable (3, Fig. 5) to junction on Tachometer/Temperature Reader (2).

NOTE: For good contact, put a layer of grease between temperature sensor and inlet line. Put a shop towel around sensor to decrease the effect of outside air temperature.

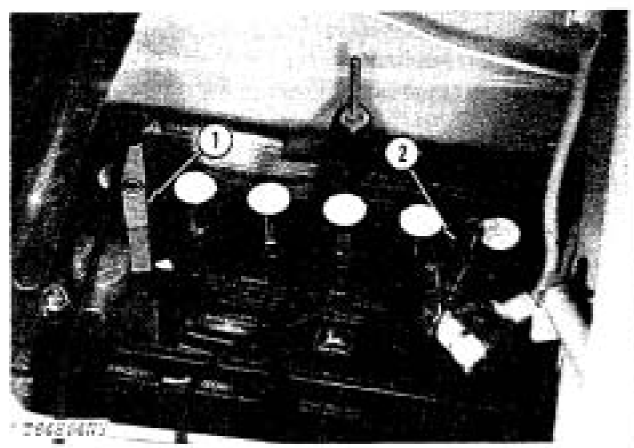


1—Power/RPM Cable
2—Magnetic Pickup
3—202703 Mounting Plate (short)

Fig. 7-Install Magnetic Pickup

Install magnetic pickup (2, Fig. 7) and mounting plate (3) to timing hole in flywheel housing. Turn magnetic pickup clockwise into plate until it is stopped by the teeth on flywheel. Turn magnetic pickup counterclockwise 1/4 to 1/2 turn and tighten lock nut.

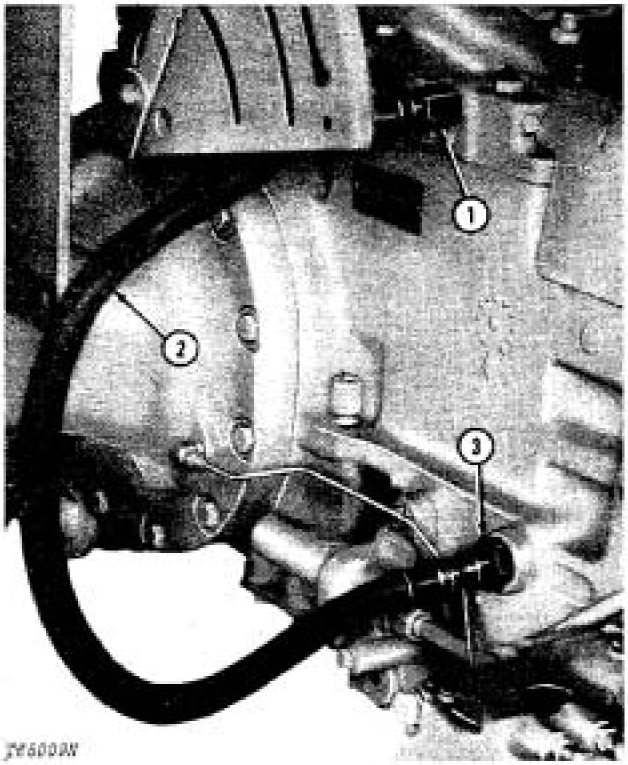
Connect power/rpm cable (1) to magnetic pickup. Connect power/rpm cable (4, Fig. 5) to junction on Tachometer/Temperature Reader. Turn thumb dials (1) to 142.



1—Red Clip (Positive Post)
2—Black Clip (Negative Post)

Fig. 8-Electrical Connection

Connect red clip (1, Fig. 8) and black clip (2) of power/rpm cable to battery.



1—202768 Orifice 0.086 in. (2.18 mm)
2—37548 Hose Assembly 40 in. (1 016 mm)
3—202807 Special Adapter

Fig. 9-Install Orifice

Before the installation of orifice make any necessary repairs of the rockshaft. Any leakage from rockshaft can cause a bad test of main pump.

Remove the flow control valve from rockshaft housing. See Section 50, Group 55.

Install orifice, Part No. 202768, (1, Fig. 9) into rockshaft housing.

Remove plug and install special adapter (3) into bore of filter relief valve. Do not remove the filter relief valve. Install hose assembly (2).

Write the test specifications (Fig. 10) on the Closed-Center Hydraulic System Test Record (Form M-5112 Stock 8-76). See example of Test Record (Fig. 11).

On units with reverser put the control lever for reverser in neutral. Engage the neutral latch.

Units with a rockshaft, put the load selector lever in the "D" position. Do not move the control lever for rockshaft during test.

Start the engine and run at 1500 rpm.

NOTE: With orifice installed as shown in Fig. 9 and the engine running, the main pump is in stroke.

Heat the hydraulic oil to 122 to 131°F (50 to 55°C) with orifice flow. There is orifice flow when the orifice is installed as shown in Fig. 9 and the engine is running.

IMPORTANT: For accurate test results keep the temperature of oil between 122 and 131°F (50 and 55°C) for all tests.

Follow the steps on the next page.

HYDRAULIC OIL TEMPERATURE: 122 to 131°F(50 to 55°C) sensor on main pump inlet line
ORIFICE USED: 202768, 0.086 in. (2.18mm) remove the flow control valve from rockshaft and install orifice
SETTING OF THUMB DIALS: 142

ENGINE RPM	MAIN PUMP OUTLET PRESSURE		MAIN PUMP INLET PRESSURE		TRANSMISSION PUMP OUTLET
	IN STROKE	STANDBY	IN STROKE	STANDBY	STANDBY
1000	1500 to 1650 psi (103 to 114 bar)	2200 to 2300 psi (152 to 159 bar)	10 to 35 psi (0.7to 2.41 bar)	15 to 40 psi (1.03 to 2.76 bar)	145 to 160 psi (9.99 to 11.03 bar)
2200		2200 to 2350 psi (152 to 162 bar)	30 to 130 psi (2 to 9 bar)	30 to 130 psi (2 to 9 bar)	145 to 170 psi (9.99 to 11.72 bar)
1830 MAX.	2000 psi (138 bar)	HIGH PRSSURE CIRCUIT TEST			

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NOTE: For units with no reverser there is no specification for transmission pump outlet. The remainder of the specifications are the same.

Fig. 10-Test Specifications

1. Run the engine at 1000 rpm.

2. Write the pressure of main pump outlet and inlet on Test Record.

3. Run the engine at 2200 rpm.

4. Write the pressure of main pump inlet on Test Record.

5. Run the engine at low idle. Slowly increase engine rpm until there is 2000 psi (138 bar) at main pump outlet. Write the rpm needed for high pressure circuit test on Test Record.

6. Stop the engine.

CAUTION: Stop the engine. Operate the steering valve or loader control valve to release hydraulic pressure in the system.

Slowly disconnect hose assembly from special adapter. Install a plug (202849) into hose. Put a cap (203093) on special adapter.

7. Start the engine and run at 1000 rpm.

NOTE: The main pump is now in standby.

8. Write the pressure of main pump outlet and inlet on Test Record.

9. Write the pressure of transmission pump outlet on Test Record (units with a reverser).

10. Run the engine at 2200 rpm.

11. Write the pressure of main pump outlet and inlet on Test Record.

12. Write the pressure of transmission pump outlet on Test Record (units with a reverser).

CLOSED-CENTER HYDRAULIC SYSTEM TEST RECORD

Date ____________

Work Order No. ____________

(Attach to Hydraulic System Pretest Check Sheet)

TEST SPECIFICATIONS:

Hydraulic Oil Temperature: 122 to 131 °F (50 to 55 °C)

High Pressure Circuit Test: While main pump outlet pressure is at 2000 psi, engine speed must not be greater than 1830 rpm.

Transmission Pump Test: ____________ Use 0.156 orifice, Part No. 203663. With transmission pump pressure at 120 PSI (Bar) engine speed must not exceed 2480 RPM.

1

ENGINE RPM	MAIN PUMP OUTLET PRESSURE In Stroke	MAIN PUMP OUTLET PRESSURE Standby	MAIN PUMP INLET PRESSURE In Stroke	MAIN PUMP INLET PRESSURE Standby	TRANS. PUMP OUTLET Standby
1000	1500 to 1650 psi	2200 to 2300 psi	10 to 35 psi	15 to 40 psi	145 to 160 psi
2200		2200 to 2350 psi	30 to 130 psi	30 to 130 psi	145 to 170 psi
1830 max	2000 psi	HIGH PRESSURE CIRCUIT TEST			
		TRANSMISSION PUMP TEST			

TEST RECORD 2

	ENGINE RPM	MAIN PUMP OUTLET PRESSURE In Stroke	MAIN PUMP OUTLET PRESSURE Standby	MAIN PUMP INLET PRESSURE In Stroke	MAIN PUMP INLET PRESSURE Standby	TRANS. PUMP OUTLET Standby
TEST 1	1000	1585 psi N	2250 psi N	41 psi H	46 psi H	150 psi N
	2200		2300 psi N	108 psi H	121 psi H	165 psi N
	1790 N	2000 psi	HIGH PRESSURE CIRCUIT TEST			
			TRANSMISSION PUMP TEST			

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1—Test Specifications

2—Test Results

Fig. 11-Example of Test Record for Closed-Center Hydraulic System (Form M-5112 Stock 8-76)

Make a comparison between the test results (2, Fig. 11) and test specifications (1). Put a mark of classification by each test result as shown in the example. Use these classifications.

H - High pressure or High rpm
N - Normal pressure or Normal rpm
L - Low pressure or Low rpm
P - Pulsing pressure - Pulsing is combined with other classifications. For example, NP means pressure is normal but unsteady.

Find the test pattern on your Test Record in the Test Pattern Analysis Chart, page 70-26-13. The chart will give a probable cause and a verification and/or correction.

NOTE: Test patterns for units with no reverser are similar except there is no pattern for transmission pump outlet.

TEST PATTERN ANALYSIS CHART

PATTERN	PROBABLE CAUSE	VERIFICATION AND/OR CORRECTION
N N L L L/N N L L L/N N	Restriction of the transmission filter element.	Install a new element (Section 50, Group 60). TEST AGAIN.
	Failure of the transmission filter relief valve (damage to seat, weak or broken spring, valve open all the time).	Inspect and install new parts as necessary (Section 50, Group 60). TEST AGAIN.
	Restriction of the transmission suction screen.	Clean or install new part as necessary. TEST AGAIN.
	Failure of gasket between reverser control valve and clutch housing. Wrong gasket installed.	Inspect and install new parts as necessary (Section 50, Group 15). TEST AGAIN.
	Transmission pump housing or gears worn.	Do the Transmission Pump Test, page 70-26-17.
N N L L N L L N	Failure of the transmission pump relief valve (units with no reverser).	Inspect and install new parts as necessary (Section 50, Group 60).
N N N N L N N N L N	Spring for pressure regulating valve is weak.	Inspect spring. Install new part as necessary. (Section 50, Group 15).
	Setting for pressure regulating valve is low.	Do the Reverser System Pressure Test, page 70-26-22.
N N H H N N H H N N	Restriction in oil cooler or lines.	Inspect oil cooler and lines. Clean or install new parts as necessary (Section 50, Group 60).
N N N N N N L L N N	Failure of the cooler relief valve (damage to seat, weak or broken spring, valve open all the time.	Inspect and install new parts as necessary (Section 50, Group 15).

TEST PATTERN ANALYSIS CHART

PATTERN	PROBABLE CAUSE	VERIFICATION AND/OR CORRECTION
L N N N N N N N N H	Worn or broken components in main pump. Damage to seats of inlet and outlet valves.	Inspect the main pump. Install new parts as necessary (Section 50, Group 10).
N L N N N L N N N H	Setting of standby pressure is low.	Do the Standby Pressure Test, page 70-26-19.
N N N N N N N N N H	Components of stroke control valve are worn or weak.	Inspect components of stroke control valve. Install new parts as necessary (Section 50, Group 10).
	Setting of crankcase outlet valve is wrong. Valve is open all the time.	Inspect valve and spring. Install new parts as necessary (Section 50, Group 10).
L L/N L L N N L L N H	High pressure leakage from a non-return circuit (steering valve, pressure control valve, rockshaft or selective control valve).	Check components for too much heat. Too much heat is an indication of leakage at high pressure. To check the steering valve or selective control valve, disconnect the inlet line to component. Put a cap on fitting. Do the test again. If pattern is normal, leakage is in that component.
N H N N N H N N N N	Setting of standby pressure too high. Restriction of the filter screen for stroke control valve.	Do the Standby Pressure Test, page 70-26-19. Clean or install new part as necessary (Section 50, Group 10).

Circuit Leakage Test

HYDRAULIC SYSTEM TEST RECORD

HYDRAULIC TEST SPECIFICATIONS: USE (__________) ORIFICE, PART NO. __________________
WHILE PRESSURE IS AT ________ PSI (__________ BAR)
MAXIMUM ENGINE SPEED MUST BE LESS THAN________ RPM.
HYDRAULIC OIL TEMPERATURE MUST BE ________ °F (________________ °C)

SYSTEM RELIEF VALVE SETTING: SPEC __________ PSI (_________ BAR)
ACTUAL __________ PSI (_________ BAR)

CIRCUIT	CIRCUIT RELIEF SETTING SPEC	CYCLE TIME SPEC	CYCLE TIME ACTUAL	Rpm at 17 bar 250 PSI	Rpm at 34 bar 500 PSI	Rpm at 52 bar 750 PSI	Rpm at 69 bar 1000 PSI	Rpm at 86 bar 1250 PSI	Rpm at 103 bar 1500 PSI	Rpm at 120 bar 1750 PSI	Rpm at 138 bar 2000 PSI	Rpm at 155 bar 2250 PSI	Rpm 172 bar 2500 PSI
Rockshaft			2	1120	1220	1320	1420	1520	1620	1720	1820		
Boom Up		4.50	3	1125	1230	1340	1450	1560	1670	1780	1890		
Boom Down		2.60	4	1120	1220	1320	1420	1520	1620	1720	1820		
											1		

Z65019N

1—Check Condition of Circuits At This Pressure
2—Rockshaft, Standard Circuit
3—Boom Up, Indication of Leakage
4—Boom Down, Normal Circuit

Fig. 12-Example of Test Record for Hydraulic System (Form M-5107 Stock 5-76)

Use this general procedure to check for the leakage of oil inside the circuits. Check each circuit in both directions. Use the Test Record (Fig. 12) to make a record of the test results. Use the Test Record to make a diagnosis of the problem. For cycle times see Fig. 13.

Connect Hydraulic Analyzer as shown in System Test, page 70-26-8. Do the System Test before checking for leakage in circuits.

NOTE: It is not necessary to connect the transmission pump outlet and main pump inlet for this test.

Heat the hydraulic oil to 122 to 131°F (50 to 55°C) with orifice flow. See System Test, page 70-26-8 for procedure. Also operate the other functions so the oil is warm when their circuits are checked.

IMPORTANT: For accurate test results keep the temperature of the oil between 122 and 131°F (50 and 55°C) for all tests.

Follow the procedure below to check for leakage of oil in a circuit.

1. Put the cylinder(s) for a function at the end of its stroke (extended or retracted). Let control lever return to neutral.
2. Put the main pump in stroke. Run engine just fast enough so there is 2000 psi (138 bar) at the main pump outlet.
3. While looking at the pressure gauge operate the control lever (step 1) in the same direction as before. Any decrease of pressure is an indication of leakage in that circuit. Write the name of the circuit on the Test Record (Fig. 12).
4. Put the cylinder(s) to the other end of its stroke (retracted or extended). Let control lever return to neutral. Do steps 2 and 3 again.
5. Check all circuits as in steps 1, 2, 3 and 4. Write the name of circuits on the Test Record if there is an indication of leakage.
6. Put the main pump in stroke. Run the engine just fast enough to get each pressure setting shown on the Test Record. Start at 2000 psi (138 bar) and work down to 250 psi (17 bar). Write the rpm needed for each pressure setting on Test Record. This is the standard circuit (2, Fig. 12).
7. To check a circuit with leakage, put the cylinder at the end of its stroke and hold the control lever in that position. Put the main pump in stroke. Run the engine just fast enough to get each pressure setting on the Test Record. Start at 2000 psi (138 bar) and work down to 250 psi (17 bar). Write the rpm needed for each pressure setting on Test Record. Check each circuit that has an indication of leakage.
8. Make a comparison between the standard circuit and a circuit with leakage.

   All engine rpm in a circuit are more than engine rpm in the standard circuit. The rpm increase becomes more as the pressure goes up. Probable causes are cylinder leakage or leakage inside the control valve (valve spool, anti-cavitation valve, etc.). To find if the leakage is in the control valve or cylinder do the Cylinder Leakage Test, page 70-26-16.

LOADER FUNCTIONS	CYCLE TIMES	LIFT CHECK
Boom Up	4.50 sec.	YES
Boom Down (power)	2.60 sec.	YES
Bucket Dump	3.20 sec.	YES
Bucket Rollback		YES
REMOTE FUNCTIONS		
Cylinder Extended (at 2100 rpm)	2.00 sec.	NO
ROCKSHAFT FUNCTION		
Rockshaft Up (at 2100 rpm)	1.90 to 2.30 sec.	Check Ball

T86013N

NOTE: Cycle times given are to be used only as a reference. When the performance is not according to the cycle times given, the service technician must make the decision if the difference is an indication of a failure of some component in the system.

Fig. 13-Tractor and Loader Functions Chart

Cylinder Leakage Test

1. Put a cylinder to the end of its stroke (extended or retracted).
2. Disconnect hydraulic oil line from cylinder at the end where cylinder is at the end of its stroke.
3. Put a cap on the line.
4. Start engine and run at slow idle. While looking at the open inlet, activate the circuit in the same direction as in step 1.
5. A constant flow of oil is an indication of bad piston V-packings. Install new parts as necessary (Section 50, Group 65).
6. No flow of oil is an indication of leakage in that section of the control valve. Inspect and install new parts as necessary (Section 50, Group 45).

Transmission Pump Test

Connect the Tachometer/Temperature Reader as shown in System Test, page 70-26-8.

Install a manual destroke valve into the stroke control valve housing if unit is not equipped. Do not turn valve in at this time.

Remove the footrest from the right (R.H.) side of unit. This will give you easier access to the transmission filter relief valve.

With orifice flow, heat the hydraulic oil to 100 to 110°F (38 to 43°C). See System Test for procedure.

NOTE: If orifice is not installed, operate the loader function to heat the hydraulic oil.

CAUTION: To prevent an injury to you by hot oil carefully remove transmission oil filter cover and element.

When the hydraulic oil is hot (100 to 110°F [38 to 43°C]), stop the engine. Immediately remove the transmission oil filter cover and element. Install the tool kit, fittings, orifice (Part No. 203663) and hose assemblies as shown in Figs. 14 and 15.

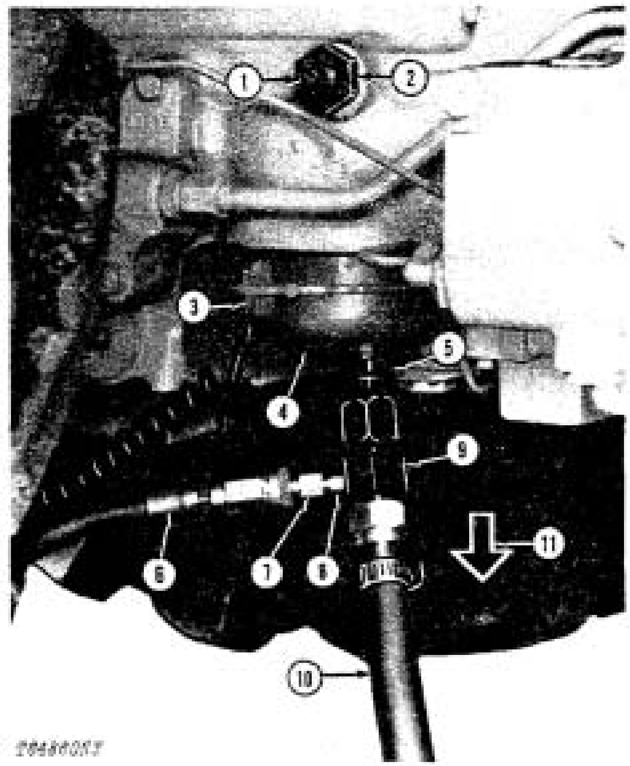
Put the end of return hose (10, Fig. 14) into the filler tube (Fig. 16).

Connect hose assembly (6, Fig. 14) to No. 3 coupling adapter on Hydraulic Analyzer.

With a plastic strap, fasten temperature sensor (3) to cover assembly (4).

NOTE: For good contact, put a layer of grease between temperature sensor and cover.

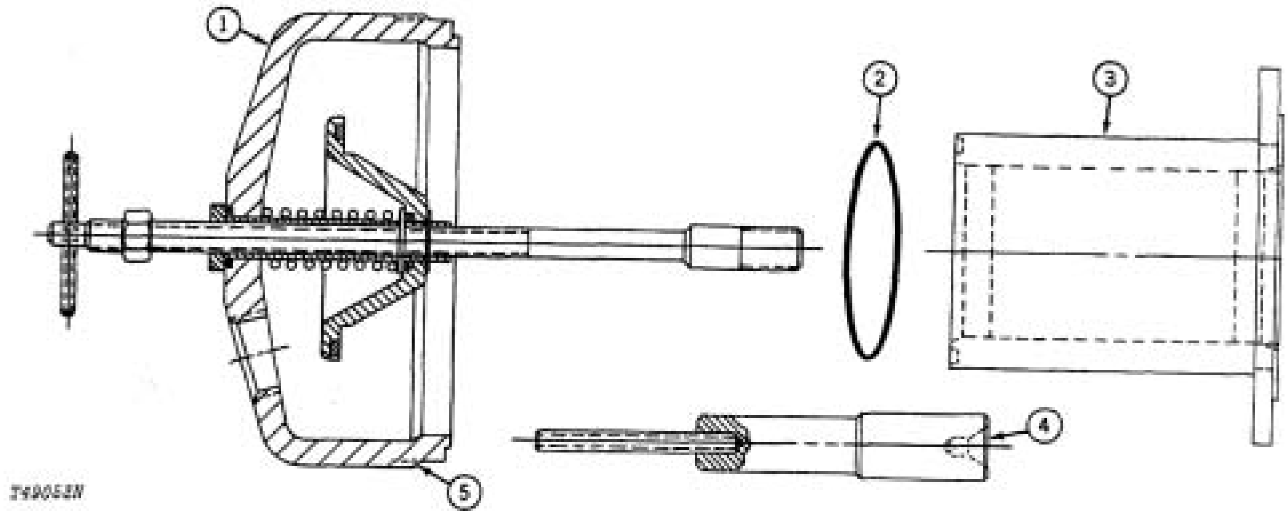
Remove the transmission filter relief valve. Install the spool assembly (1) and special adapter (2). This will prevent the loss of oil from circuit during test.



1—JD-293-4 Spool Assembly
2—202807 Special Adapter
3—Temperature Sensor
4—JD-293-1 Filter Housing Cover Assembly
5—17502 Special Fitting
6—36952 Hose Assembly 144 in. (3 658 mm)
7—202850 Coupling Adapter
8—202853 Straight Fitting
9—203663 Orifice 0.156 in. (3.96 mm)
10—203658 Return Hose
11—Direction of Flow

Fig. 14-Installation for Transmission Pump Test

Turn the manual destroke valve in to destroke the main pump. Keep test short because no charge oil goes to the main pump during test.



1—JD-293-1 Filter Housing Cover Assembly
2—O-Ring
3—JD-293-2 Filter Assembly
4—JD-293-4 Spool Assembly
5—Grind Here to Clear Transmission Case

Fig. 15-Transmission Pump Tool Kit

Start engine and run at low idle. Check for leakage.

NOTE: If there is leakage from special adapter, check for the proper installation of components. If leakage is from filter cover remove it and grind (5, Fig. 15) cover so it will clear transmission case.

Slowly increase engine rpm until there is 150 psi (10.34 bar) on pressure gauge. Write the engine rpm and temperature on Test Record.

Engine rpm must be less than 2460 rpm with pressure at 150 psi (10.34 bar) and a minimum temperature of 100°F (38°C).

If engine rpm is more than 2460 remove transmission pump for repair (Section 50, Group 5).

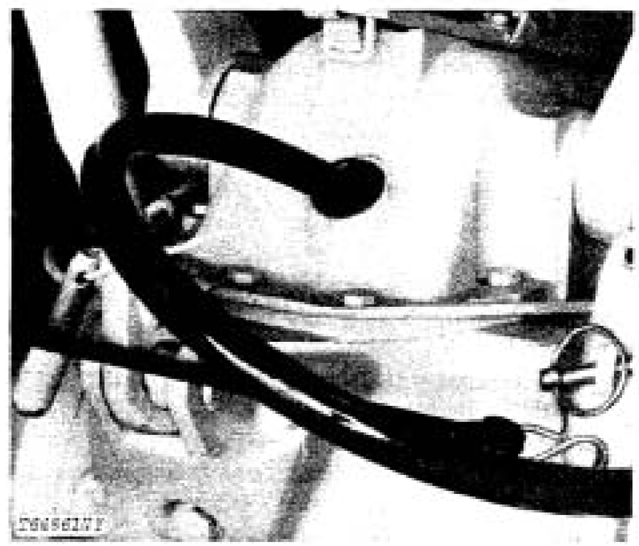
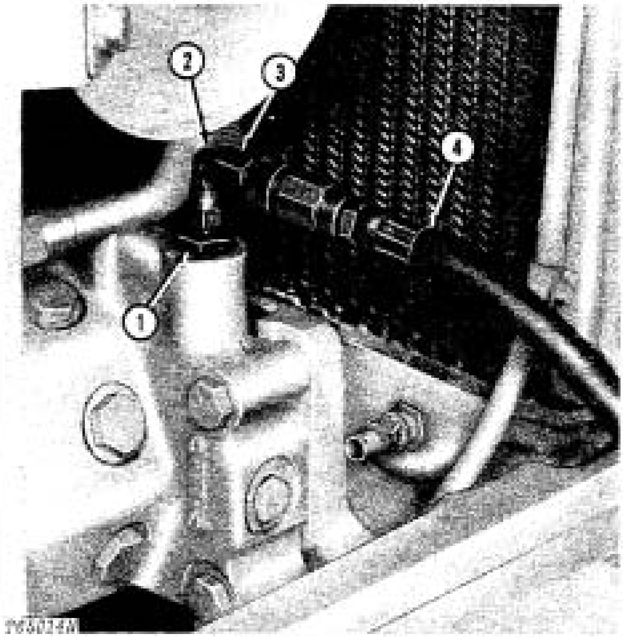


Fig. 16-Put Return Hose Into Filler Tube

Standby Pressure Test



1—202855 Straight Fitting (Pump Outlet Pressure)
2—202851 Swivel Elbow 90°
3—202850 Coupling Adapter
4—36953 Hose Assembly with Valve 144 in. (3 658 mm)

Fig. 17-Main Pump Test Connection

CAUTION: Stop the engine. Operate the steering valve and loader control valve to release hydraulic pressure in the system.

Slowly remove plug from test port of main pump to release the remainder of any hydraulic pressure in system.

Install fittings (1 to 3, Fig. 17) and hose assembly (4) into test port. Connect hose assembly to No. 1 coupling adapter on Hydraulic Analyzer.

Install the Tachometer/Temperature Reader as shown in System Test, page 70-26-8.

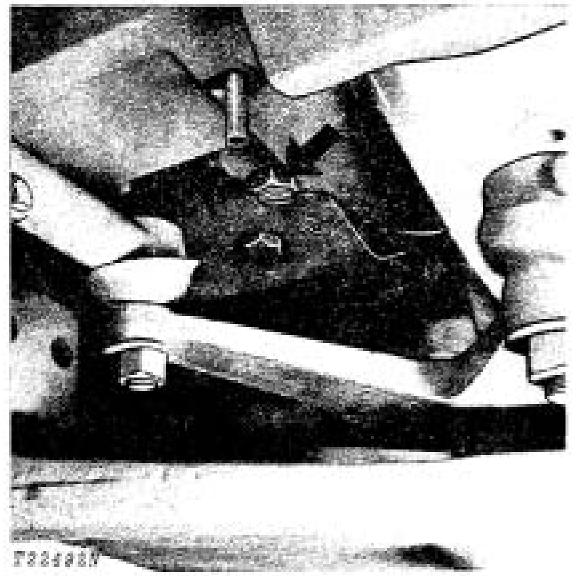


Fig. 18-Standby Pressure Adjustment Screw Location

Start engine and run at fast idle. Operate the hydraulic functions to heat the hydraulic oil to 122 to 131°F (50 to 55°C).

NOTE: If orifice is installed, use orifice flow to heat the hydraulic oil. After the oil is heated, stop the engine and disconnect the orifice.

Run the engine at 2500 rpm. Read the standby pressure on the pressure gauge. Standby pressure is 2250 ± 50 psi (155 ± 3 bar).

If an adjustment is necessary, turn the screw (Fig. 18) clockwise to increase standby pressure or counterclockwise to decrease standby pressure.

Pressure Control Valve Test
(-246127)

Operational Test

Start engine and run at fast idle.

Operate the hydraulic functions (loader, steering valve, etc.) to heat the hydraulic oil.

With engine at slow idle turn the steering wheel to the left (L.H.) and right (R.H.). Take note of the force needed to turn the steering wheel.

Again turn the steering wheel and at the same time operate a non-priority circuit (loader, selective control valve or rockshaft). The force needed must be the same. Any loss of steering power is an indication of a problem with the pressure control valve.

NOTE: Do not make any adjustment of the pressure control valve using the operational test. Use a pressure gauge for the adjustment. See below.

Pressure Test

CAUTION: Stop the engine. Operate the steering valve and loader control valve to release hydraulic pressure in the system.

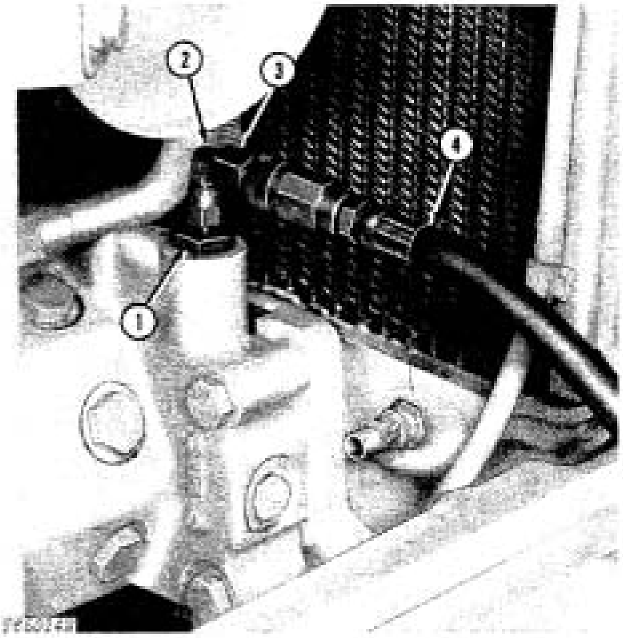
Slowly remove plug from the test port of pump to release the remainder of any hydraulic pressure in system.

Install fittings (1 to 3, Fig. 19) and hose assembly (4) into test port. Connect hose assembly to No. 1 coupling adapter on the Hydraulic Analyzer.

Lower the setting of standby pressure to 1500 psi (103 bar).

Operate one of the non-priority circuits (loader, selective control valve or rockshaft). There must be no movement of a function.

If a function does operate, there is a problem in the pressure control valve (probable: dirt in valve or a broken spring). Clean or install new parts as necessary (Section 50, Group 25).



1—202855 Straight Fitting (Pump Outlet Pressure)
2—202851 Swivel Elbow 90°
3—202850 Coupling Adapter
4—36953 Hose Assembly With Valve 144 in. (3 658 mm)

Fig. 19-Main Pump Test Connection

Make a selection of one of the functions below and operate it as given:

1. Lower the rockshaft, then move the control lever to the lift position.

2. Put a remote cylinder in the retracted position, then move control lever to the opposite position.

Slowly turn the adjustment screw of the stroke control valve clockwise. Turn screw clockwise until the function (step 1 or 2) is operating at a normal speed.

Read the pressure gauge. The pressure setting must be 1750 ± 50 psi (120 ± 3 bar). Add or remove shims as necessary for the correct setting (Section 50, Group 25).

After the adjustment of pressure control valve, do the adjustment for standby pressure, page 70-26-19.

Pressure Control Valve Test (246128-)

Operational Test

Start engine and run at fast idle.

Operate the hydraulic functions (loader, steering valve, etc.) to heat the hydraulic oil.

With engine at slow idle (1000 rpm) turn the steering wheel to the left (L.H.) and right (R.H.). Take note of the force needed to turn the steering wheel.

Again turn the steering wheel and at the same time operate the loader control valve (boom up). The force needed to turn steering wheel must be the same. Any loss of steering power is an indication of a problem with the pressure control valve.

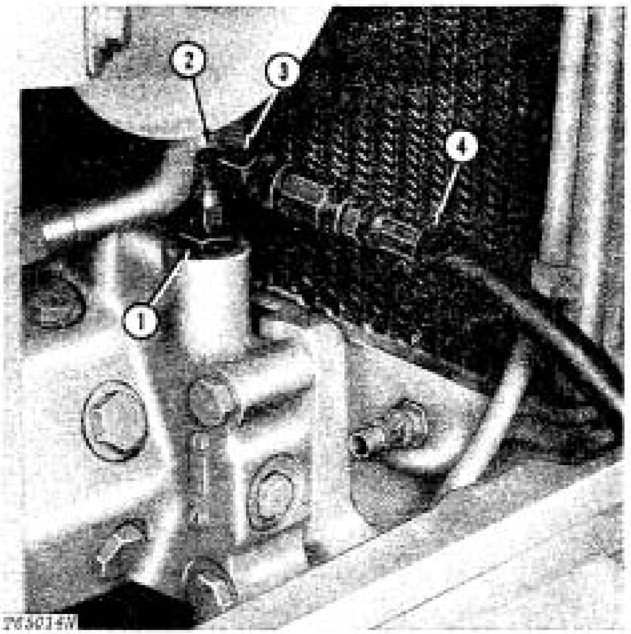
NOTE: Do not make any adjustment of the pressure control valve using the operational test. Use a pressure gauge for the adjustment. See below.

Pressure Test

CAUTION: Stop the engine. Operate the steering valve and loader control valve to release hydraulic pressure in the system.

Slowly remove plug from the test port of pump to release the remainder of any hydraulic pressure in system.

Install fittings (1 to 3, Fig. 20) and hose assembly (4) into test port. Connect hose assembly to No. 1 coupling adapter on the Hydraulic Analyzer.



1—202853 Straight Fitting (Pump Outlet Pressure)
2—202851 Swivel Elbow 90°
3—202850 Coupling Adapter
4—36953 Hose Assembly with Valve 144 in. (3 658 mm)

Fig. 20-Main Pump Test Connection

Start engine and run at 1000 rpm.

Operate the loader control valve (boom up). Read the pressure setting on pressure gauge. The pressure setting must be 1600 ± 50 psi (110 ± 3 bar).

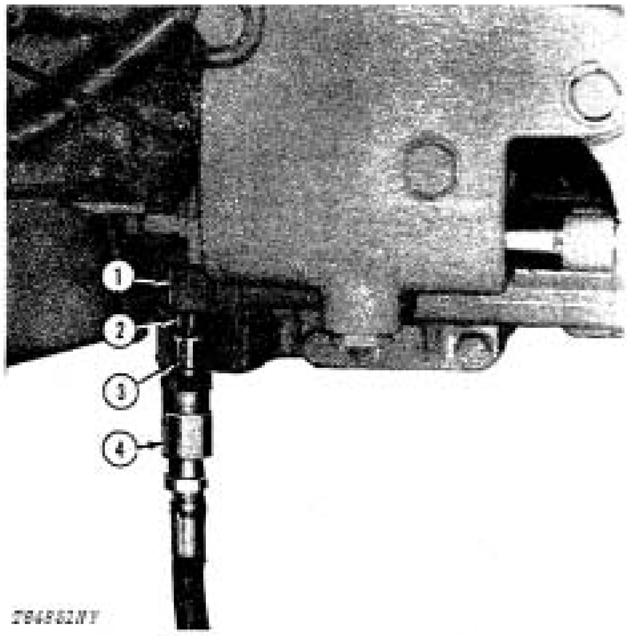
NOTE: The pressure read while operating the loader with no load is the setting of the pressure control valve.

Add to or remove from the pressure control valve the quantity of shims necessary for the correct setting (Section 50, Group 25).

NOTE: For units with no loader use one of the other non-priority circuits (rockshaft or selective control valve).

Reverser System Pressure Test

Pressure Regulating Valve Adjustment



1—Reverser Clutch Control Valve
2—202853 Straight Fitting
3—202850 Coupling Adapter
4—36952 Hose Assembly 144 in. (3 658 mm)

Fig. 22-Reverser System Pressure

Remove plug from cover of control valve (1, Fig. 22). Install fittings (2 and 3) and hose assembly (4) into test port. Connect hose assembly to No. 3 coupling adapter on Hydraulic Analyzer.

Install the Tachometer/Temperature Reader as shown in System Test, page 70-26-8.

Start the engine and run at fast idle. Operate the hydraulic functions to heat the hydraulic oil to 122 to 131°F (50 to 55°C). Also operate the control lever for the reverser.

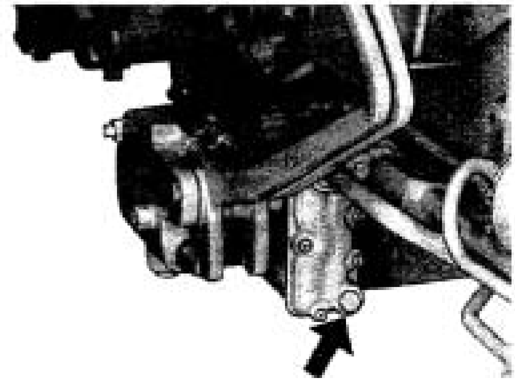


Fig. 23-Pressure Regulating Valve Location

Put the control lever for reverser in neutral, the clutch pedal in the engaged position, and run the engine at 2200 rpm.

The pressure for the reverser system must be 145 to 170 psi (9.99 to 11.72 bar) with the temperature of oil at 122 to 131°F (50 to 55°C) and engine at 2200 rpm.

If necessary add to or remove from the pressure regulating valve (Fig. 23) the quantity of shims necessary for the correct setting (Section 50, Group 15).

Clutch Control Valve Adjustment

Do this adjustment after the adjustment for pressure regulating valve.

NOTE: Before making any adjustment of the clutch control valve, check that the adjustment for wear of the disconnect clutch is corrected (Section 70, Group 20).

Install the Tachometer/Temperature Reader and pressure gauge as in the adjustment for pressure regulating valve.

Start the engine and run at fast idle. Operate the hydraulic functions to heat the hydraulic oil to 122 to 131°F (50 to 55°C). Also operate the control lever for the reverser.

Put the transmission shift lever in "park" position. Run the engine at 2200 rpm. Put the reverser control lever in either forward or reverse. Record pressure reading and check remaining shift position. Pressure reading should read the same in either position.

Pressure reading should be full engagement pressure. If reading does not fall within this range, adjust valve as follows:

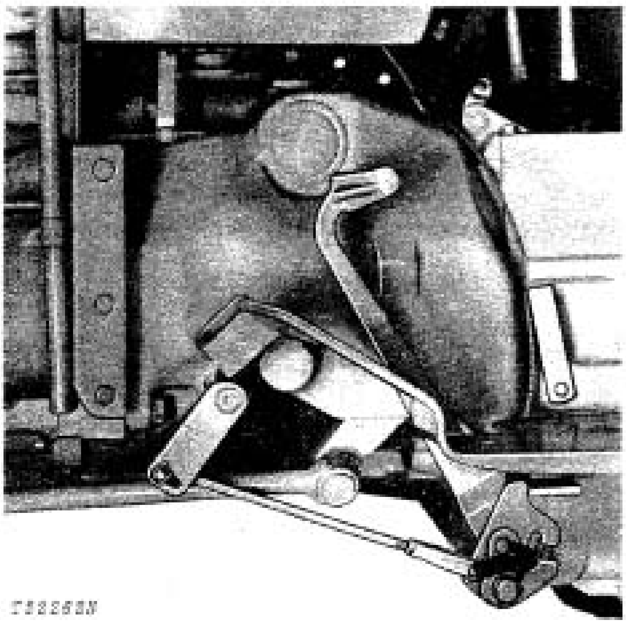


Fig. 24-Clutch Pedal Shaft Arm Adjusting Screw

Loosen clutch pedal-to-clutch pedal shaft arm screw and adjust the clutch pedal shaft arm adjusting screw until a reading of 130 psi (9.14 kg/cm²) is shown on the gauge. Turn the screw in 1-1/2 turns and tighten jam nut. Tighten clutch pedal-to-clutch pedal shaft screw with pedal in upper position. Pressure reading will now be correct full engagement pressure.

If pressure is not within the specified range, repeat check on clutch pack not tested. If results are within correct range, check for excessive leakage in the oil circuit of the other clutch pack oil circuit. Check both clutch oil circuits if oil pressure is still below the desired specification.

Shift Adjustment

The reverser may be adjusted for a firm rapid shift or for a slower shift. It is desirable to have the speed-of-shift as rapid as possible without a jerky shifting motion.

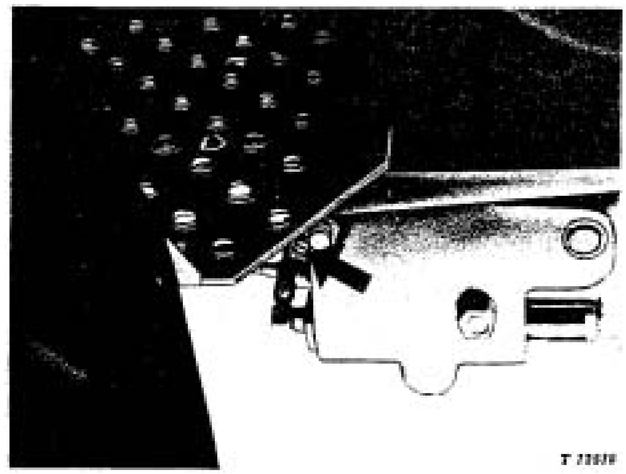


Fig. 25-Speed-Of-Shift Adjusting Screw

To adjust reverser shifting, stop the engine and locate the speed-of-shift adjusting screw (accumulator charging orifice screw) located on the rear side of the control valve cover (Fig. 25).

Turn IN the adjusting screw with a screwdriver to slow down the shift. To speed up the shift for heavy loads or when the shift becomes too slow, back OUT the adjusting screw. Turn the adjusting screw one-fourth turn at a time until the desired speed of shift is obtained.

Shift time should be 3/4 to 1-1/4 seconds.

LIST OF PARTS FOR TESTS

System Test

1. 202703 Mounting Plate (short)
2. 202768 Orifice 0.086 in. (2.18 mm)
3. 202772 Elbow Adapter 90° (-290934)
4. 202807 Special Adapter
5. 202849 Plug
6. 202850 Coupling Adapter (3 needed)
7. 202851 Swivel Elbow 90°
8. 202853 Straight Fitting (2 needed)
9. 202855 Straight Fitting
10. 203093 Cap
11. 36952 Hose Assembly 144 in. (3 658 mm) (2 needed)
12. 36953 Hose Assembly with Valve 144 in. (3 658 mm)
13. 37548 Hose Assembly 40 in. (1 016 mm)
14. Magnetic Pickup
15. Temperature Sensor Cable and Strap
16. Power/RPM Cable
17. D-01080AA Master Hydraulic System Analyzer
18. D-01084AA Tachometer/Temperature Reader

Circuit Leakage Test

1. 202703 Mounting Plate (short)
2. 202768 Orifice 0.086 in. (2.18 mm)
3. 202807 Special Adapter
4. 202850 Coupling Adapter
5. 202851 Swivel Elbow 90°
6. 202855 Straight Fitting
7. 36953 Hose Assembly with Valve 144 in. (3 658 mm)
8. 37548 Hose Assembly 40 in. (1 016 mm)
9. Magnetic Pickup
10. Temperature Sensor Cable and Strap
11. Power/RPM Cable
12. D-01080AA Master Hydraulic System Analyzer
13. D-01084AA Tachometer/Temperature Reader

Transmission Pump Test

1. 202703 Mounting Plate (short)
2. 202807 Special Adapter
3. 202850 Coupling Adapter
4. 202853 Straight Fitting
5. 203658 Return Hose
6. 203663 Orifice 0.156 in. (3.96 mm)
7. 17502 Special Fitting
8. 36952 Hose Assembly 144 in. (3 658 mm)
9. JD-293 Transmission Pump Tool Kit
10. Magnetic Pickup
11. Temperature Sensor Cable and Strap
12. Power/RPM Cable
13. D-01080AA Master Hydraulic System Analyzer
14. D-01084AA Tachometer/Temperature Reader

Standby Pressure Test

1. 202703 Mounting Plate (short)
2. 202850 Coupling Adapter
3. 202851 Swivel Elbow 90°
4. 202855 Straight Fitting
5. 36953 Hose Assembly with Valve 144 in. (3 658 mm)
6. Magnetic Pickup
7. Temperature Sensor Cable and Strap
8. Power/RPM Cable
9. D-01080AA Master Hydraulic System Analyzer
10. D-01084AA Tachometer/Temperature Reader

Pressure Control Valve Test

1. 202850 Coupling Adapter
2. 202851 Swivel Elbow 90°
3. 202855 Straight Fitting
4. 36953 Hose assembly with Valve 144 in. (3 658 mm)
5. D-01080AA Master Hydraulic System Analyzer

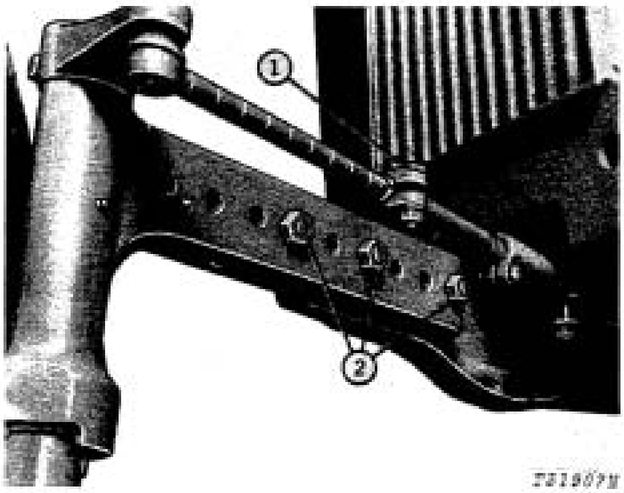
Reverser System Pressure Test

1. 202703 Mounting Plate
2. 202850 Coupling Adapter
3. 202853 Straight Fitting
4. 36952 Hose Assembly 144 in. (3 658 mm)
5. Magnetic Pickup
6. Temperature Sensor Cable and Strap
7. Power/RPM Cable
8. D-01080AA Master Hydraulic System Analyzer
9. D-01084AA Tachometer/Temperature Reader

Group 30
MISCELLANEOUS COMPONENTS

ADJUSTMENT

Adjustable Front Axle



1—Tie Rod Clamp Screw 2—Axle Bolt Nuts

Fig. 1-Front Wheel Tread Adjustment

On units with a swept back adjustable front axle, adjust the front wheel tread as follows:

Jack up front end of tractor.

NOTE: Do not place jack under oil pan.

Loosen tie rod clamp screw (1) and remove axle bolts.

Reposition axle ends and insert bolts. Tighten nuts (2) to standard torque.

Tie rods have grooves every inch to simplify adjustment. Adjust the same distance as the axles and tighten tie rod clamp screw to standard torque. Check to see that front wheels turn equally to right and left. Check toe-in and adjust if necessary.

NOTE: To obtain the widest front wheel tread (measured center-to-center at hub height), screw out the threaded end of each tie rod 1 inch [25.4 mm] (to hole in tie rod tube).

Wheel tread width on all tire sizes, except those listed below, is 49 to 74 inches [1.24 to 1.88 m]. With wheels reversed, the maximum tread width on all tires sizes, except those listed below is 79 inches [2.01 m].

Tire Size	Wheel tread
27 x 9.50-15	52 to 69 inches [1.32 to 1.75 m]
26 x 12-12	55 to 72 inches [1.40 to 1.83 m]
11L-15	54 to 79 inches [1.37 to 2.01 m]

NOTE: With mower installation use adjustable front axle with tread width at 66 inches [1.68 m] minimum.

IMPORTANT: To avoid stress on axle bolts, do not separate axle halves beyond the above limits. Bolt spacings should be 4 inches [101.6 mm] in maximum tread width and 6 inches [152.4 mm] in all other tread widths.

Front Wheel Toe-In Adjustment

Wheel tread options on the adjustable front axle are listed above. On units equipped with the solid front axle, tread width of 7.50-16 tires is 56 inches [1.42 m]. With wheels reversed, tread width is 62 inches [1.57 m]. Tread width of 11L-15 tires is 62 inches [1.57 m].

Check the toe-in of the front wheels periodically as follows:

1. Use down pressure of loader bucket to raise front wheels. Turn wheels so each valve stem is at bottom of tire.

2. Lower wheels to ground.

3. Measure from ground to hub.

4. Mark this distance on inside of each rim at the head of tire front and rear.

5. Measure distance between rims at front and rear marks.

6. Distance between front of rims must be 1/8 to 3/8 in. (3.2 to 9.5 mm) less than distance between rear of rims.

   If distance in step 6 is not correct, change toe-in as follows:

1. Loosen clamps (Fig. 1) on tie rods (four clamps total).

2. Turn each tie rod the same number of turns until toe-in distance is correct.

3. Be sure tie rod ends are equal in length.

4. The tie rod slot must be turned to the rear.

5. Tighten cap screws on all four clamps to 40 lb-ft (54 Nm) (6 kg-m).

IMPORTANT: Never screw out tie rod ends too far. Maintain at least one inch (25.4 mm) of thread engagement in tube. This can be viewed through small hole in tie rod.

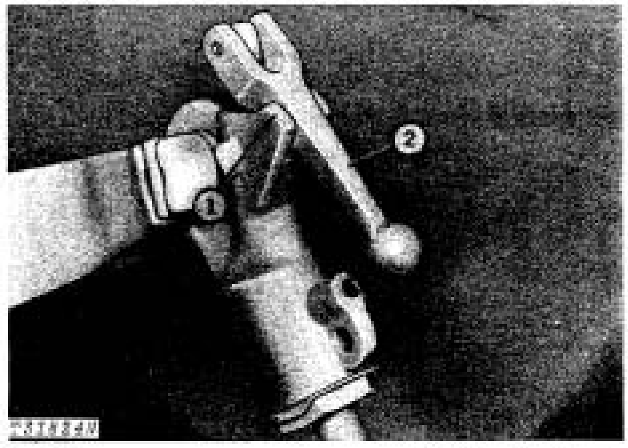
Turn wheels from full right to full left.

On units with manual steering, stops on knuckles should contact stops on knees. If necessary, adjust tie rods so equal contact is made.

On units with power steering, stops on knuckles should not contact stops on knees. If necessary, adjust tie rods to give equal distance between stops.

When finished be sure slots in tubes face to the rear. Position outer clamp so that screw head is to the front.

3-Point Hitch Lift Link Adjustment



1—Lock 2—Adjusting Handle

Fig. 2-Lift Link Adjustment

Adjust the lift links to level a mounted tool from side to side, for more transport clearance or extra working depth.

The right lift link has an adjusting handle. To adjust, raise handle and rotate it. Then drop handle into the lock as shown.

The left lift link is adjustable by removing lower pin and screwing yoke end in or out. Reinstall pin.

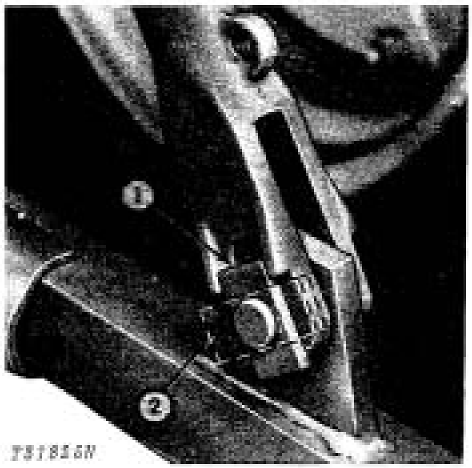
Keep the length of the lift links and center link within the limits shown in the chart below to avoid damage to hitch parts.

APPROVED LENGTH LIMITS FOR ADJUSTABLE HITCH LINKS
(Measured Between Centers of Attaching Pins)

Type	Minimum	Maximum
Lift Links (Regular)	23-7/8 in. [606.42 mm]	28-5/8 in. [727.87 mm]
[727.87 mm]		
Lift Links (With Telescoping Draft Links)	21-3/8 in. [542.92 mm]	26-1/8 in. [663.57 mm]
Center Link	23-5/16 in. [592.14 mm]	28-1/2 in. [723.9 mm]

NOTE: The lift link dimensions given above are with float locked out.

3-Point Hitch Lateral Float Adjustment



T31825N

1—Float Position 2—Float Locked Out

Fig. 3-Float Adjustment

Some attachments, such as those equipped with gauge wheels, must float from side to side to follow ground contours.

To adjust for float, remove cap screw securing lift link to draft link. Turn steel plate 90 degrees as shown and reinstall cap screw. This will allow approximately 1 inch [25.4 mm] of float travel.

Group 35
SPECIFICATIONS AND SPECIAL TOOLS

ENGINE

SPECIFICATIONS AND TORQUE VALUES

Basic Engine

Minimum compression readings:
Diesel .... 300 psi (21.09 kg/cm²)
Gasoline .... 120 psi (8.49 kg/cm²)

The most important factor in compression readings is the difference between cylinders. This difference should be no more than 25 psi (1.8 kg/cm²).

Engine Lubrication System

Oil pressure at 2500 rpm with engine at normal operating temperature..... 50 ± 15 psi (3.5 ± 1.05 kg/cm²).

Engine Cooling System

Fan Belt Adjustment

With Gauge
(initial) .... 100 to 110 lbs. (45.4 to 49.9 kg) tension
(after 3 minutes of operation) .... 80 lbs. minimum (36.3 kg)

Without gauge .... 3/4-inch (19.0 mm) flex at 25 lbs. force (11.3 kg)

Fuel System

Fuel supply pump at low idle
Vacuum .... 2 to 2.5 inches of water (50.8 to 63.5 mm)
Pressure .... 2 to 2.5 psi (0.14 to 0.17 kg/cm²)

Injection pump cam advance
JDB331AL2406
Advance at 1300 rpm (no load) .... 4°

ENGINE

SPECIFICATIONS AND TORQUE VALUES—Continued

Speed Control Linkage

	Gasoline	Diesel
Fast idle		
Hand throttle full clockwise	2680 rpm	2650 ± 25 rpm
Foot throttle pedal against footrest	2800 rpm	2800 rpm
Slow idle	600 rpm	825 ± 25 rpm

Gasoline Adjustments
- Carburetor-to-governor rod .... 1 turn short
- Clearance of speed control rod end past governor lever attaching hole .... 1/8-inch (3.175 mm)

Diesel Adjustments
- Override on pump lever (preload) .... 1/4-inch (6.35 mm)

Air Intake System

Air restriction indicator shows red when water vacuum gauge reads ..... 14 to 25 inches of water (355.6 to 635 mm) of water

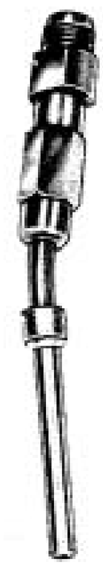
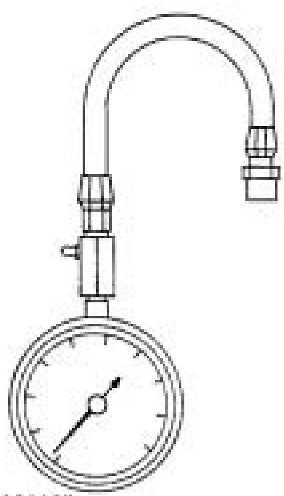
Intake manifold (gasoline) vacuum at high idle (2650 rpm) .... 15 to 20 psi (1.05 to 1.41 kg/cm²)

ENGINE

SPECIAL TOOLS

Essential Tools

Basic Engine

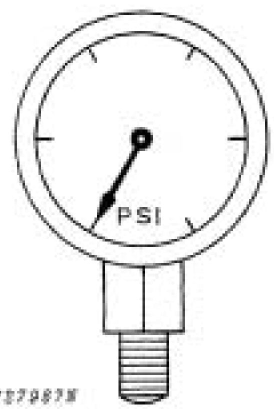
Tool	Tool Number	Use
 T21926NY Fig. 1-Compression Gauge Adapter	D-14550 BA	Compression Gauge Adapter - To check diesel engine compression
 T27985N Fig. 2-Compression Gauge	D-14547 BA	Compression Gauge - To check diesel engine compression
	(Not Illustrated)	Gasoline Engine Compression Tester - To check gasoline engine compression

ENGINE

SPECIAL TOOLS_Continued

Essential Tools—Cont.

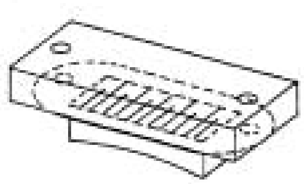
Engine Lubrication System

Tool	Tool Number	Use
 T87987N *Fig. 3-Pressure Gauge*	------	Pressure Gauge - To check oil pressures.

Engine Cooling System

Tool	Tool Number	Use
	(Not Illustrated)	Radiator Pressure Tester - To check radiator for leaks.

Fuel System

Tool	Tool Number	Use
 T81980N *Fig. 4-Injection Pump Timing Window*	JD-259(13366)	Timing Window - To adjust injection pump cam advance.

ENGINE

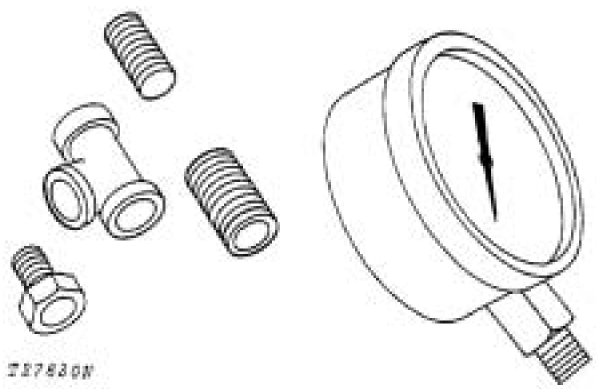
SPECIAL TOOLS—Continued

Convenience Tools

Engine Cooling System

Tool	Tool Number	Use
	(Not Illustrated)	Fan Belt Tension Gauge - To check fan belt tension.

Fuel System

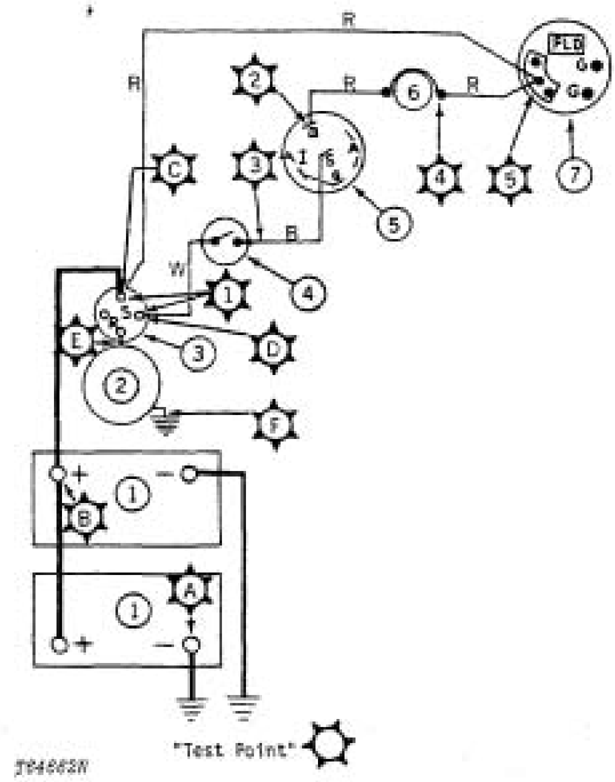
Tool	Tool Number	Use
	D-05022ST	Water Vacuum Gauge - To check fuel and air vacuums.

Z27630N

Fig. 5-Water Vacuum Gauge

ELECTRICAL SYSTEM
SPECIFICATIONS AND TORQUE VALUES

Starting Circuit Test Values



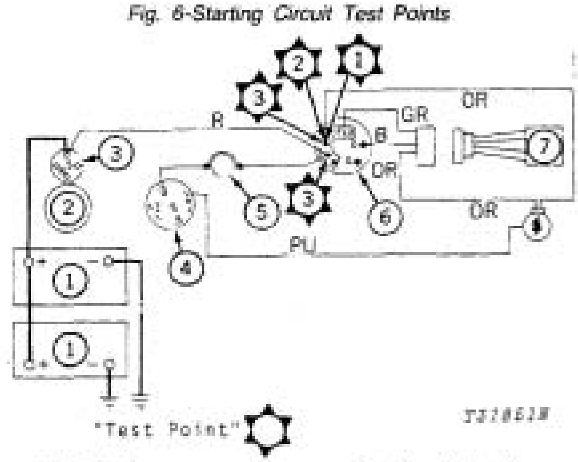
1—Batteries
2—Starting Motor
3—Solenoid
4—Neutral Start Switch
5—Key Switch
6—Circuit Breaker
7—Alternator

Fig. 6-Starting Circuit Test Points

Test No. 1 .... 9.0 to 12.0 volts
Test No. 2 .... 9.0 to 12.0 volts
Test No. 3 .... 9.0 to 12.0 volts
Test No. 4 .... 9.0 to 12.0 volts
Test No. 5 .... 9.0 to 12.0 volts

High Resistance Test

Test Points	Maximum Voltage Reading
A-F	0.2 volt
B-C	0.2 volt
C-D	1.0 volt
C-E	0.2 volt



1—Batteries
2—Starting Motor
3—Solenoid
4—Key Switch
5—Circuit Breaker
6—Alternator
7—Regulator

Fig. 7-Charging Circuit Test Points

Charging Circuit Test Valves

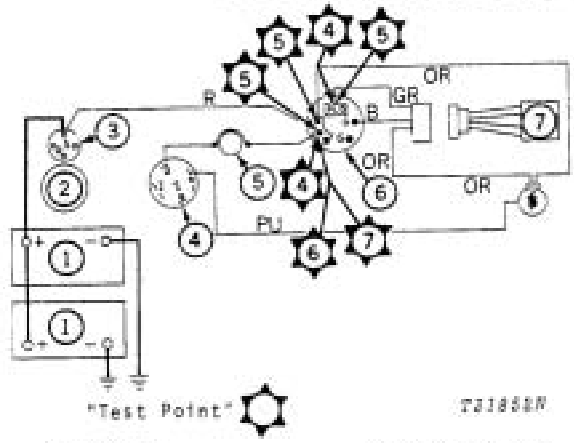
Test No. 1 - Isolation Diode Check (Key Switch Off) .... 0 volts

Test No. 2 - Field Circuit Check (Key Switch On, Engine Not Running)...1.5 - 2.5 volts

Test No. 3 - Isolation Diode Check (Key Switch On, Engine Running)
Regulator terminal .... 15.4 volts
Output terminal .... 14.4 volts

ELECTRICAL SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued



1—Batteries
2—Starting Motor
3—Solenoid
4—Key Switch
5—Circuit Breaker
6—Alternator
7—Regulator

Fig. 8-Charging Circuit Test Points

Test No. 4 - Field Draw Test (Key Switch Off) .... 2 to 2.5 amps

Test No. 5 - Checking Alternator and Regulator with Regulator Disconnected (Key Switch On, Engine Running) .... 15 to 16 volts

Test No. 6 - Alternator Output .... 25 amps at 13 to 15 volts

Test No. 7 - Testing Regulator (after fifteen minutes of operation at 1500 rpm) See chart.

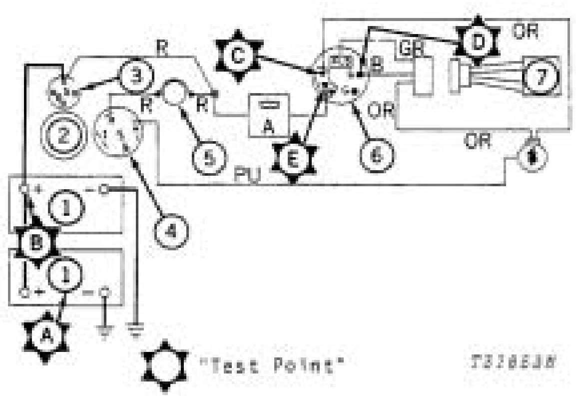
Temperature*	Voltage
40°F [4.4°C]	14.4 - 14.9 volts
60°F [15.6°C]	14.3 - 14.7 volts
80°F [26.7°C]	14.2 - 14.6 volts
100°F [37.8°C]	14.0 - 14.4 volts
120°F [48.9°C]	13.8 - 14.3 volts
140°F [60.0°C]	13.6 - 14.1 volts

**Measured one inch from regulator.*

High Resistance Test

Test Points	Maximum Voltage Reading
A-D	0.3 volt
B-E	0.3 volt
B-C	1.3 volts

10-amp charging rate

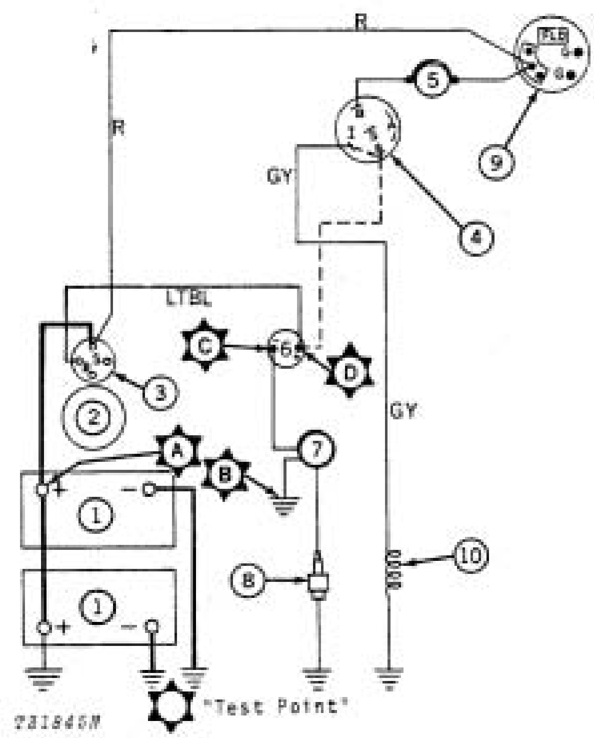


1—Batteries
2—Starting Motor
3—Solenoid
4—Key Switch
5—Circuit Breaker
6—Alternator
7—Regulator

Fig. 9-High Resistance Test Points

ELECTRICAL SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued



1—Batteries
2—Starting Motor
3—Solenoid
4—Key Switch
5—Circuit Breaker
6—Coil
7—Distributor
8—Spark Plug
9—Alternator
10—Regulator

Fig. 10-Ignition Circuit Test Points

Ignition Circuit Test Valves

Voltmeter Connected To	Key Switch Position	Breaker Points	Voltage Reading
A-D	Cranking	.....	1 volt max.
B-D	Cranking	......	Approx. 10 volts
B-D	On	Open	Battery voltage
B-D	On	Closed	Approx. 4.8 volts
B-C	On	Closed	0.2 volt max.

Carburetor Shut-Off Solenoid

Winding current draw .... Approx. 0.6 amps
Winding resistance .... Approx. 20 ohms
Voltage required to energize........ Approx. 8.0 volts

Injection Pump Solenoid Winding

Winding current draw .... Approx. 2.5 amps
Winding resistance .... Approx. 5 ohms
Voltage required to energize..........Approx. 8.0 volts

Accessory Circuit

Fuel Gauge Resistance

Full .... 30 ohms
Half Full .... 15 ohms
Empty... 0 ohms

Horn

Current draw ....4.5 to 5.5 amps

ELECTRICAL SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

Light Circuit Test Values

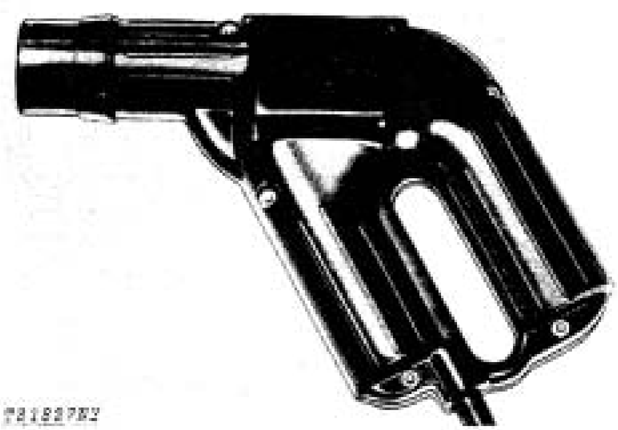
Voltage reading at lamp terminal .... Battery voltage
Maximum voltage drop between battery and lamp .... 0.5 volt
Maximum voltage drop between lamp frame and ground; across switch or connection .... 0.1 volt

Light Adjustment

Distance of upper edge from lamp center at 25 ft. (7.62 m) .... Top edge - 5 in. (127.0 mm) below centerline

SPECIAL TOOLS

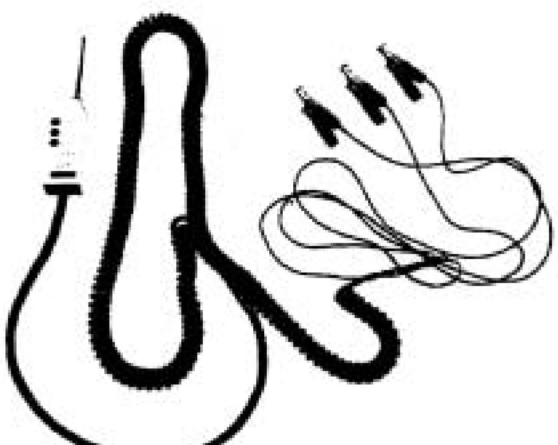
Essential Tools

Tool	Tool No.	Use
 Fig. 11-Power Timing Light	....	Time distributor

ELECTRICAL SYSTEM

SPECIAL TOOLS—Continued

Convenience Tools

Tool	Tool No.	Use
 T61677B *Fig. 12-Voltmeter, Ammeter and Ohmmeter*	D-19001 TT	Voltmeter—Check starting circuit, charging circuit, ignition circuit, and light circuit. Ammeter—Check charging circuit, ignition circuit, carburetor, shut-off solenoid, injection pump solenoid winding and horn Ohmmeter—Check carburetor shut-off solenoid, injection pump solenoid and fuel gauge sender.
 T55753NT *Fig. 13-Voltage Detector*	D-05136ST	To test starting, charging and accessory circuits to determine grounded or shorted circuit components.

POWER TRAIN

SPECIFICATIONS AND TORQUE VALUES

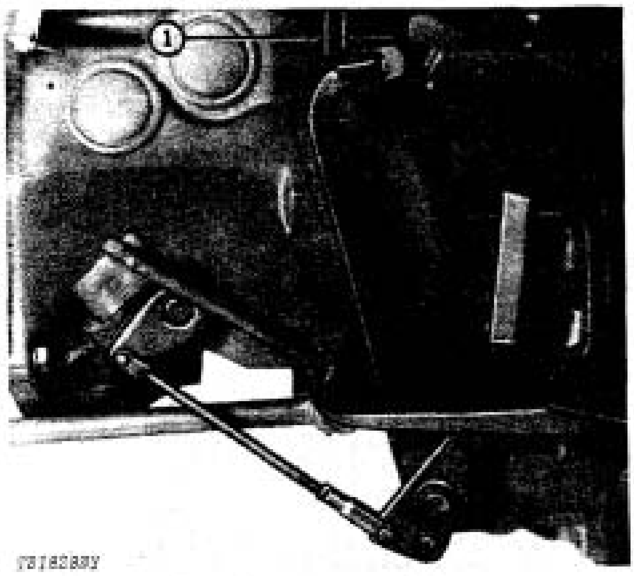


Fig. 14-Clutch Pedal Free Travel (Units Without Reverser)

1. Free travel (units with continuous PTO) ....1-in. (25.400 mm)

   Distance from the pedal arm to where the arm hits the pedal stop (units with independent or no PTO ....5 in. (127 mm)

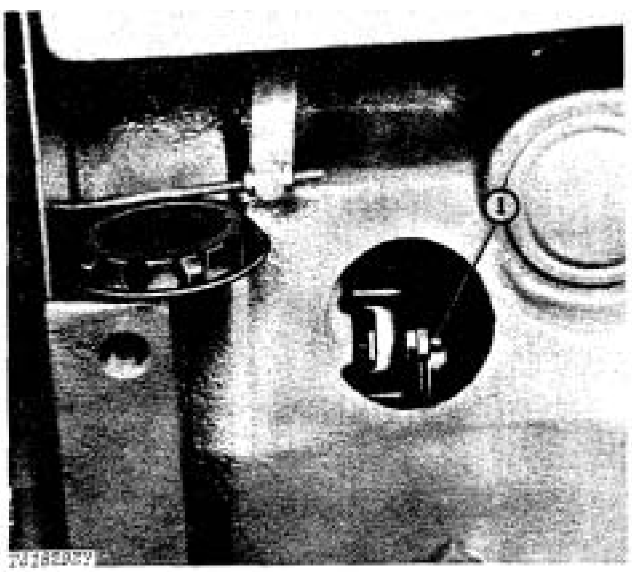


Fig. 15-Adjusting Clutch Operating Levers

1. Loosen the three clutch operating bolt nuts until the clutch operating lever contacts the powershaft clutch plate pins. Rotate flywheel and tighten operating bolt nuts 2-1/2 turns.

POWER TRAIN

SPECIFICATIONS AND TORQUE VALUES—Continued

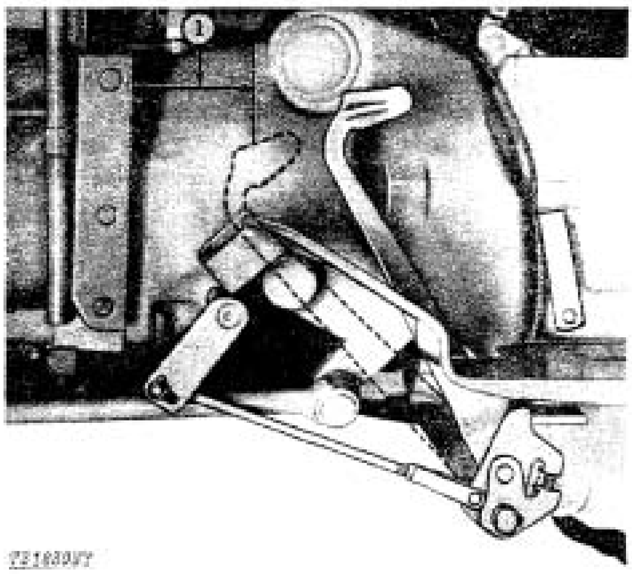


Fig. 16-Bottom Of First Stage Detent (Units with reverser)

1. Distance from the rear or face of clutch pedal pad to front of the clutch housing-to-engine bolting flange with the clutch release bearing against the clutch levers. 5-1/4 in. (133.3 mm)

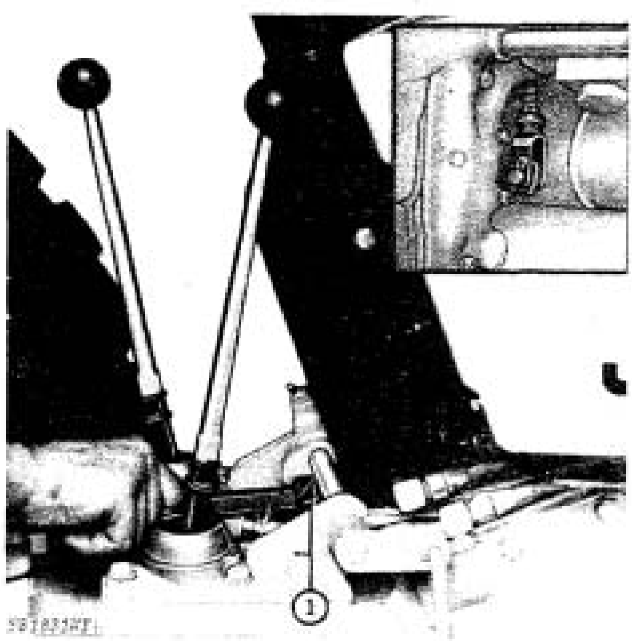


Fig. 17-Measuring High-Speed Lockout Pin Clearance

1. Clearance between control shaft arm and side of high speed lockout pin (-277191) . . . 0.040 in. (1.02 mm)

POWER TRAIN

SPECIFICATIONS AND TORQUE VALUES—Continued

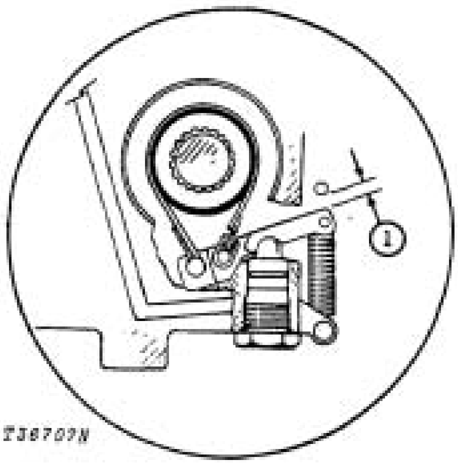


Fig. 18-PTO Brake Clearance Dimension

1. Clearance between power shaft brake lever and lever stop pin.........................0.31 to 0.50 in. (7.9 to 12.7 mm)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES

Power Steering Valve	Steering wheel shaft adjuster . . . . 50 lb-ft (6.91 kg-m)
	Adjuster jam nut . . . . 30 lb-ft (4.15 kg-m)
	Steering shaft arm to shaft . . . . 170 lb-ft (23.50 kg-m)
	Steering wheel hex. nut . . . . 50 lb-ft (6.91 kg-m)
	Drag link-to-steering shaft arm slotted nut . . . . 55 lb-ft (7.60 kg-m)
Transmission Pump	Minimum pump flow With flow meter . . . . 7 gpm (0.44 L/s) at 150 psi (10.3 bar) at 2500 rpm.
Main Hydraulic Pump	Displacement per revolution . . . . 1.38 cu. in. (22.63 cm³)
	Standby pressure . . . . 2200 to 2300 psi (154.7 to 161.7 kg/cm²) at 2500 rpm
	Minimum pump flow . . . . 8.8 gpm (0.55 L/s) at 2000 psi (138 bar) at 2000 rpm
Reverser Clutch Control Valve	Reverser pressure regulating valve adjustment . . . . 145 to 155 psi at 180°F (10.19 to 10.90 kg/cm² at 82.2°C) Full engagement pressure . . . . . . 155 to 165 psi at room temperature (90° to 110°F) (10.90 to 11.6 kg/cm² at room temperature [32.2° to 43.3°C]) Speed of shift adjustment (shift time) . . . . 3/4 to 1-1/4 seconds Lubricating oil pressure when clutch pedal is depressed . . . . 8 to 10 psi (0.4 to 0.7 kg/cm²) Cooler bypass valve (early units) Relieves to lubrication circuit at . . . . 70 psi (4.9 kg/cm²) Relieves to sump at . . . . . . 100 psi (7.0 kg/cm²) Cooler bypass valve (later or replaced units) Relieves to lubrication at . . . . 120 psi (8.4 kg/cm²) Relieves to sump at . . . . 130 psi (9.1 kg/cm²)

HYDRAULIC SYSTEM

SPECIFICATIONS AND TORQUE VALUES—Continued

Selective Control Valve	Flow at 1500 psi [105.5 kg/cm²] at 2500 rpm .... 2 gpm [7.6 l] to full pump flow
	Metering valve arm in center position .... 6 to 7 gpm [22.7 to 26.5 l]
Rockshaft	Flow control valve check .... 4.75 to 5.75 gpm [18.0 to 22.8 l]
	Thermal relief valve discharge pressures Minimum .... 3500 psi. [246.1 kg/cm²] Maximum .... 4500 psi. [316.4 kg/cm²] Closed .... 2500 psi. [175.8 kg/cm²]
Pressure Control Valve .... (-246127)	Control valve pressure .... 1700 to 1800 psi [119.52 kg/cm²]
(246128-)	Control valve pressure .... 1600 ± 50 psi (112 ± 4 kg/cm²)
	One shim changes pressure .... 35 to 40 psi [2.46 to 2.81 kg/cm²]
Independent PTO Control Valve	Clutch oil pressure at 2100 rpm at 130° to 160°F. [54.4° to 71.1°C] .... 140 to 160 psi [9.84 to 11.25 kg/cm²]
	Brake oil pressure at 2100 rpm at 130° to 160°F. [54.4° to 71.1°C] .... 140 to 160 psi [9.84 to 11.25 kg/cm²]
	Pressure regulating valve adjustment at 2100 rpm at 130° to 160°F. [54.4° to 71.1°C] ..... 140 to 160 psi [9.84 to 11.25 kg/cm²]
	Number of turns detent screws are backed out after detent springs are compressed solid .... 2 turns
Cycle Times*	Rockshaft (fully raise) .... 1.90 to 2.30 sec.
	Remote cylinder (extend) .... 2.00 sec.
	Loader control valve - boom raise .... 4.50 sec. boom lower (power) .... 2.60 sec. bucket dump (stop to stop) .... 3.20 sec.

***NOTE:** *Cycle times are to be used only as guidelines. Therefore, when unit does not perform according to the cycle times given, the mechanic must use own judgement to decide if the difference is great enough to indicate a malfunction of some component in the system.*

HYDRAULIC SYSTEM

SPECIAL TOOLS

The following test units and fittings are suggested for use in testing the hydraulic system: (not illustrated)

Tool	Tool Number	Use
Adapter	Y3001	D-71*
Connector	Y3003	D-73*
Adapter	. . . .	D-75*
Union Fitting	Y3005	D-88 (2 used)*
Connector	. . . .	D-89*
Double Female Union	Y3017 (2 used)	D-96 (2 used)*
Adapter	Y3021	. . . . .
45° Elbow	Y3023 (2 used)	D-103 (2 used)*
Connector	Y3024	. . . . .
Hose	Y21-10	D-91 (2 used)*
Hydraulic Tester	Y90	ND-1575*
Elbow	AR27699	. . . . .
Elbow	AT22339	. . . . .
Disconnect Coupler	AR30210	. . . . .

Available from Nuday Tool Company, 14615 Wyoming Avenue, Detroit, Michigan 48283

HYDRAULIC SYSTEM (ANALYZER)

SPECIFICATIONS AND TORQUE VALUES

System Test

HYDRAULIC OIL TEMPERATURE: 122 to 131°F(50 to 56°C) sensor on main pump inlet line
ORIFICE USED: 202768, 0.086 in. (2.18mm) remove the flow control valve from rockshaft and install orifice
SETTING OF THUMB DIALS: 142

ENGINE RPM	MAIN PUMP OUTLET PRESSURE		MAIN PUMP INLET PRESSURE		TRANSMISSION PUMP OUTLET
	IN STROKE	STANDBY	IN STROKE	STANDBY	STANDBY
1000	1500 to 1650 psi (103 to 114 bar)	2200 to 2300 psi (152 to 159 bar)	10 to 35 psi (0.7to 2.41 bar)	15 to 40 psi (1.03 to 2.76 bar)	145 to 160 psi (9.99 to 11.03 bar)
2200		2200 to 2350 psi (152 to 162 bar)	30 to 130 psi (2 to 9 bar)	30 to 130 psi (2 to 9 bar)	145 to 170 psi (9.99 to 11.72 bar)
1830 MAX.	2000 psi (138 bar)	HIGH PRSSURE CIRCUIT TEST			

T66648

Fig. 18-Test Specifications

Circuit Leakage Test

LOADER FUNCTIONS	CYCLE TIMES	LIFT CHECK
Boom Up	4.50 sec.	YES
Boom Down (power)	2.60 sec.	YES
Bucket Dump	3.20 sec.	YES
Bucket Rollback		YES
REMOTE FUNCTIONS		
Cylinder Extended (at 2100 rpm)	2.00 sec.	NO
ROCKSHAFT FUNCTION		
Rockshaft Up (at 2100 rpm)	1.90 to 2.30 sec.	Check Ball

T66073N

NOTE: Cycle times given are to be used only as a reference. When the performance is not according to the cycle times given, the service technician must make the decision if the difference is an indication of a failure of some component in the system.

Fig. 19-Tractor and Loader Functions Chart

Tachometer/Temperature Reader thumb dials setting 142

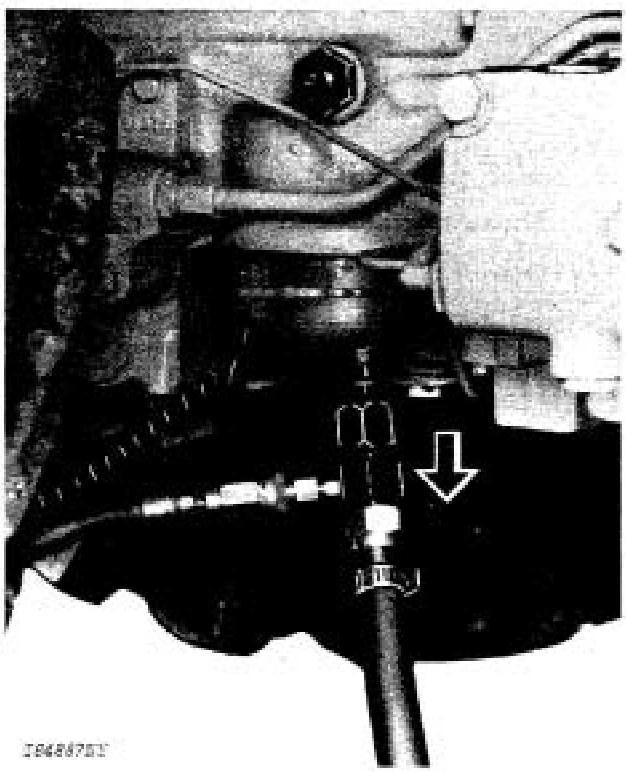
Hydraulic oil temperature (sensor on main pump inlet line) .... 122 to 131°F (50 to 55°C)

Orifice used (remove flow control valve from rockshaft and install orifice 202768
0.086 in. (2.18 mm)

HYDRAULIC SYSTEM (ANALYZER)

SPECIFICATIONS AND TORQUE VALUES—Continued

Transmission Pump Test



T64887SY

Fig. 20-Installation For Transmission Pump Test

Tachometer/Temperature Reader thumb dials setting 142

Hydraulic oil temperature (sensor on main pump inlet line) .... 100 to 110°F (38° to 43°C)

Orifice used 203663
0.156 in. (3.96 mm)

Minimum oil temperature (sensor on cover assembly) .... 100°F (38°C)

Transmission pump pressure ... 150 psi (10.34 bar)

Maximum engine rpm .... 2460 rpm

Standby Pressure Test

Hydraulic oil temperature .... 122 to 131°F (50 to 55°C)

Engine rpm .... 2500 rpm

Standby pressure .... 2250 ± 50 psi (155 ± 3 bar)

HYDRAULIC SYSTEM (ANALYZER)

SPECIFICATIONS AND TORQUE VALUES—Continued

Pressure Control Valve Test

Setting of pressure control valve (-246127)	1750 ± 50 psi (120 ± 3 bar)
Setting of pressure control valve (246128-)	1600 ± 50 psi (110 ± 3 bar)

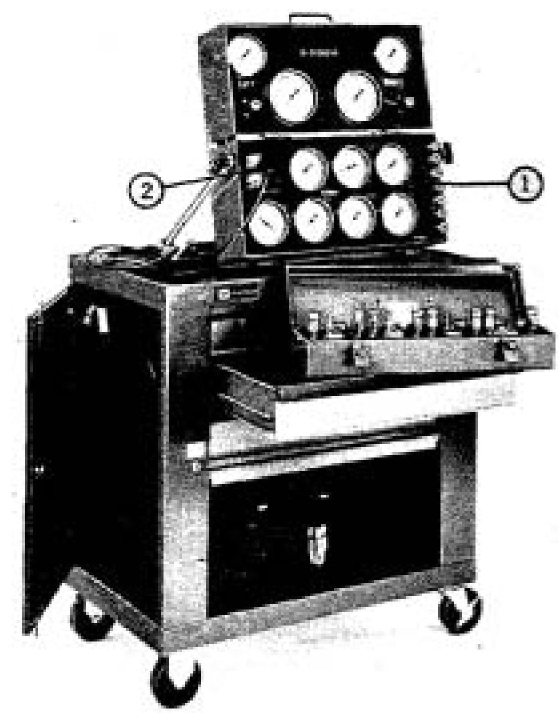
Reverser System Pressure Test

Hydraulic oil temperature (sensor on main pump inlet line)	122 to 131°F (50 to 55°C)
Engine rpm	2200 rpm
Setting of pressure regulating valve	145 to 170 psi (9.99 to 11.72 bar)
Setting of clutch control valve	130 psi (9 bar)
plus	1-1/2 turns
Cycle time of reverser (shift time)	3/4 to 1-1/4 seconds

HYDRAULIC SYSTEM (ANALYZER)

SPECIAL TOOLS

Convenience Tools

Tool	Tool Number	Use
	D-01080AA	Master Hydraulic System Analyzer - Used when testing hydraulic system.
	D-01084AA	Tachometer/Temperature Reader - Used to measure engine rpm and oil temperature.
	D-01085AA	Utility Equipment Accessory Kit - Used to make hydraulic connections.

1—Master Hydraulic System Analyzer
2—Tachometer/Temperature Reader

Fig. 21-Hydraulic System Analyzer

	JD-293	Transmission Pump Tool Kit - This tool kit is used to isolate transmission pump flow for transmission pump test.

Fig. 22-Transmission Pump Tool Kit

MISCELLANEOUS COMPONENTS

SPECIFICATIONS AND TORQUE VALUES

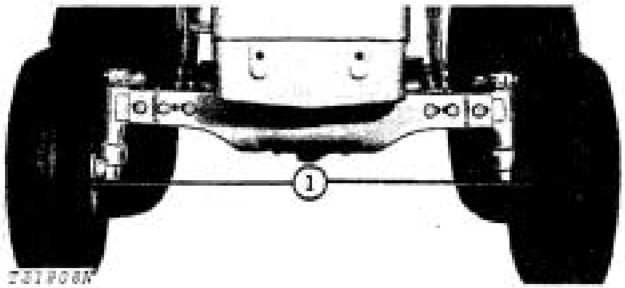


Fig. 23-Front Wheel Toe-In

1 - Front Wheel Toe-In .... 1/8 to 3/8 in. (3.2 to 9.5 mm)

Tie rod clamp cap screw torque .... 40 lb-ft (54 Nm) (6 kg-m)

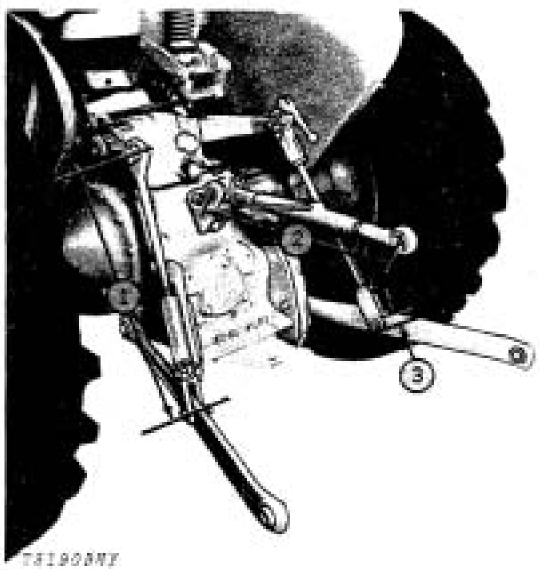


Fig. 24-Adjustable Hitch Links

	Minimum	Maximum
1 - Lift Links (Regular)	23-7/8 in. (606.42 mm)	28-5/8 in. (727.87 mm)
Lift Links .... (With Telescoping Draft Links)	21-3/8 in. (542.92 mm)	26-1/8 in. (663.57 mm)
2 - Center Link	23-5/16 in. (592.14 mm)	28-1/2 in. (723.9 mm)

3 - Float travel .... 1-in. (25.4 mm)

ALPHABETICAL INDEX

W

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